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# (54) SEMICONDUCTOR LIGHT EMITTING ELEMENT AND LIGHT EMITTING DEVICE

(71) Applicant: **TOYODA GOSEI CO., LTD.**, Kiyosu-shi, Aichi-ken (JP)

(72) Inventors: **Honglin Wang**, Ichihara (JP); **Hironao Shinohara**, Ichihara (JP); **Eisuke Yokoyama**, Ichihara (JP)

(73) Assignee: **TOYODA GOSEI CO., LTD.**, Aichi (JP)

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***H01L 27/15*** (2006.01)
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(58) **Field of Classification Search**
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See application file for complete search history.

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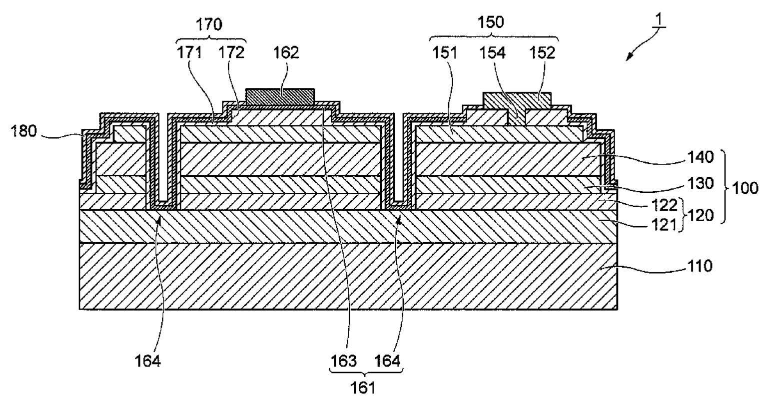
*Primary Examiner* — Teresa M Arroyo
(74) *Attorney, Agent, or Firm* — Sughrue Mion, PLLC

(57) **ABSTRACT**

A semiconductor light emitting element (**1**) includes; an n-type semiconductor layer (**120**), a light emitting layer (**130**), a p-type semiconductor layer (**140**), a p-side power supply portion (**150**), and an n-side power supply portion (**160**) that includes an n-side power supply electrode (**162**), an n-side auxiliary electrode (**163**) and n-side connective electrodes (**164**). The n-side power supply electrode (**162**) and auxiliary electrode (**163**) are provided in the inner side beyond the p-type semiconductor layer (**140**) viewed from the light emitting layer (**130**). On the p-type semiconductor layer (**140**), a power supply insulating layer (**170**) transparent to light from the light emitting layer (**130**) is provided, and portions at lower side of the n-side power supply electrode (**162**) and auxiliary electrode (**163**) are set to have a thickness with which the light is easily reflected, and other portions are set to have a thickness with which the light is easily transmitted.

**9 Claims, 16 Drawing Sheets**



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| ***H01L 31/0203*** | (2014.01) |
| ***H01L 31/00*** | (2006.01) |
| ***H01L 33/38*** | (2010.01) |
| *H01L 33/20* | (2010.01) |
| *H01L 33/36* | (2010.01) |
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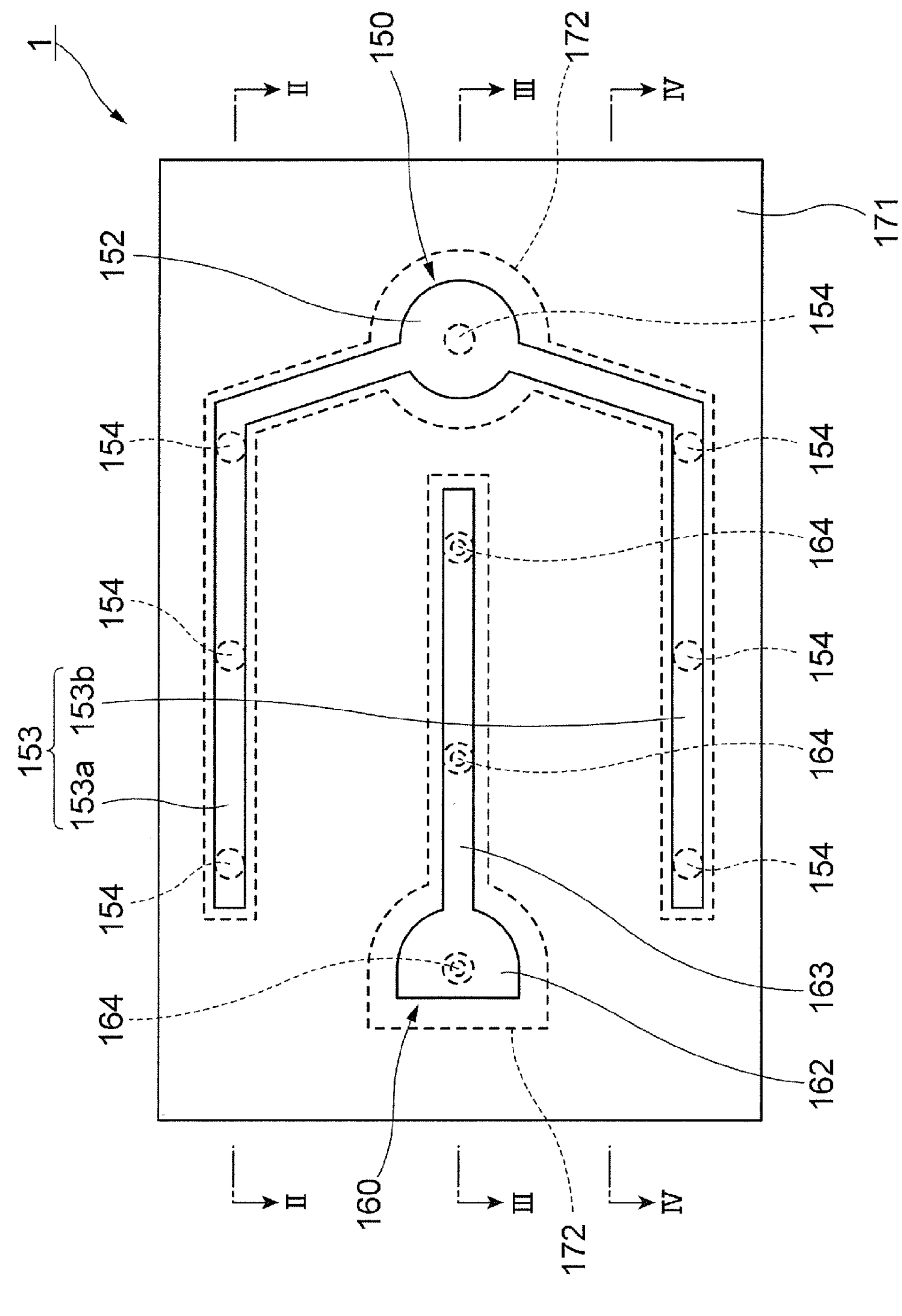
1
150
172
II
III
IV
171
152
154
154
154
154
154
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154
164
164
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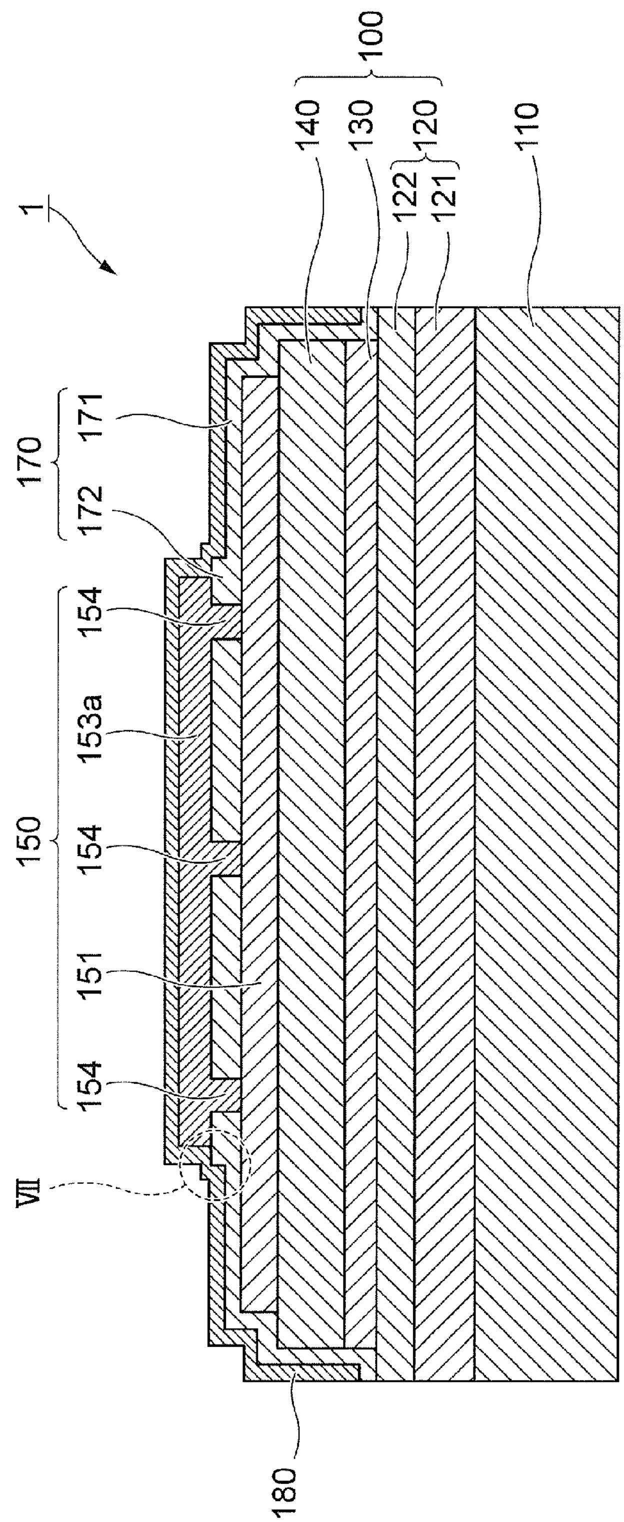
153
153a
153b
163
162
160
172
II
III
IV

FIG.1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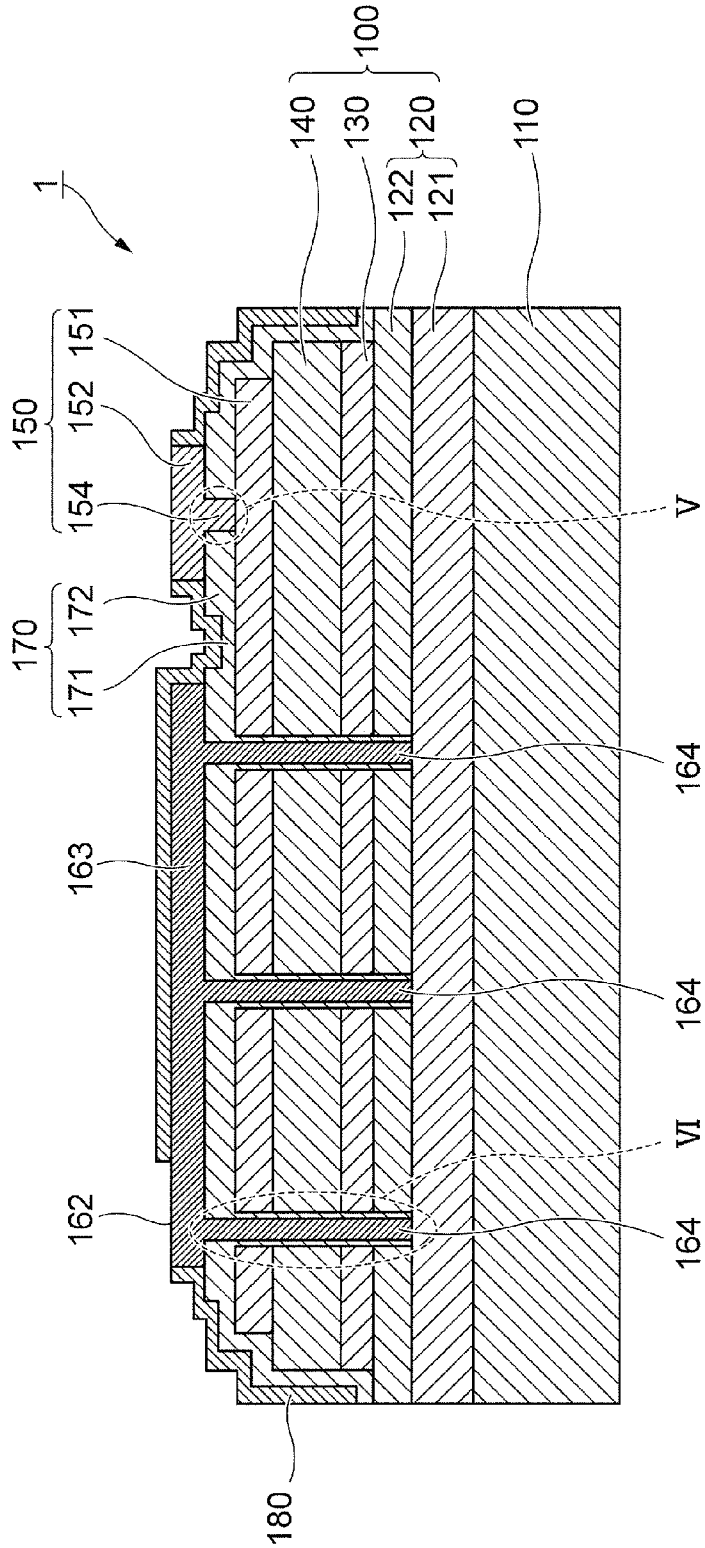
154
153a
154
151
154
VII
180

FIG.2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140
130
120
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121
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152
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V
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164
163
164
162
VI
164
180

FIG.3

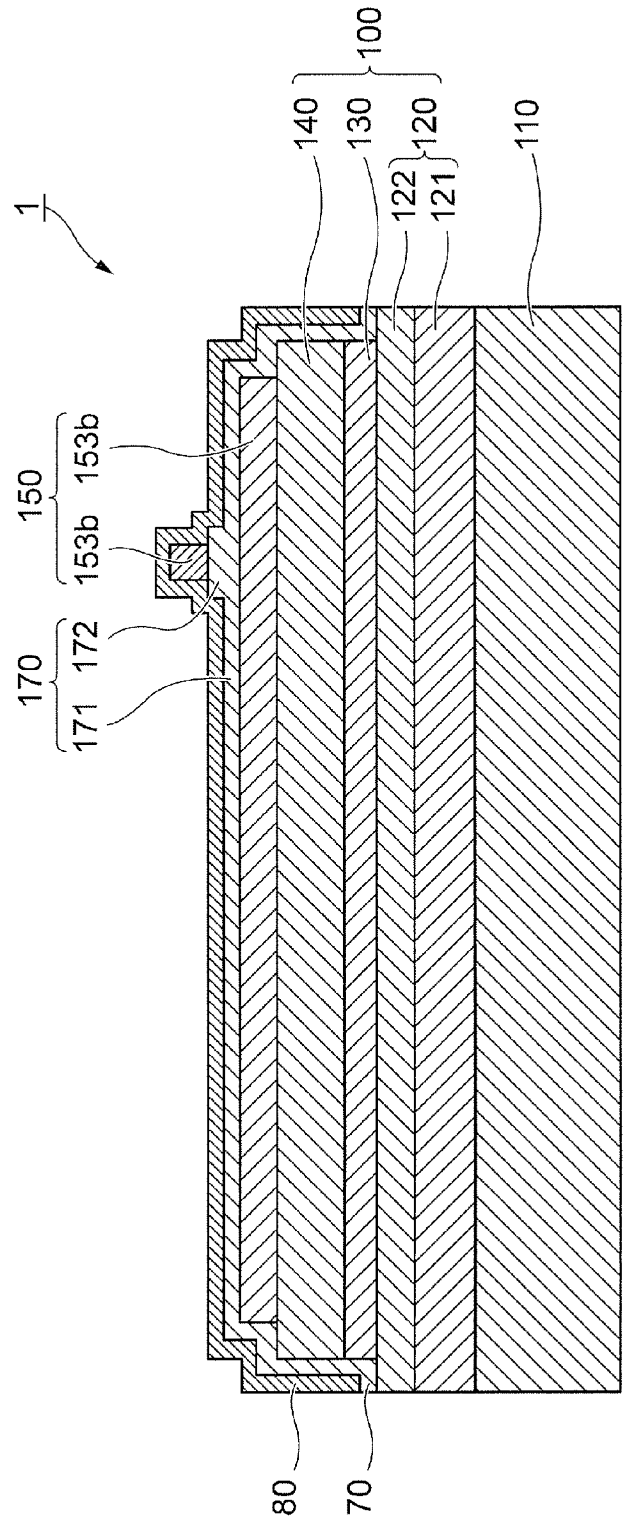



FIG.4

FIG.5

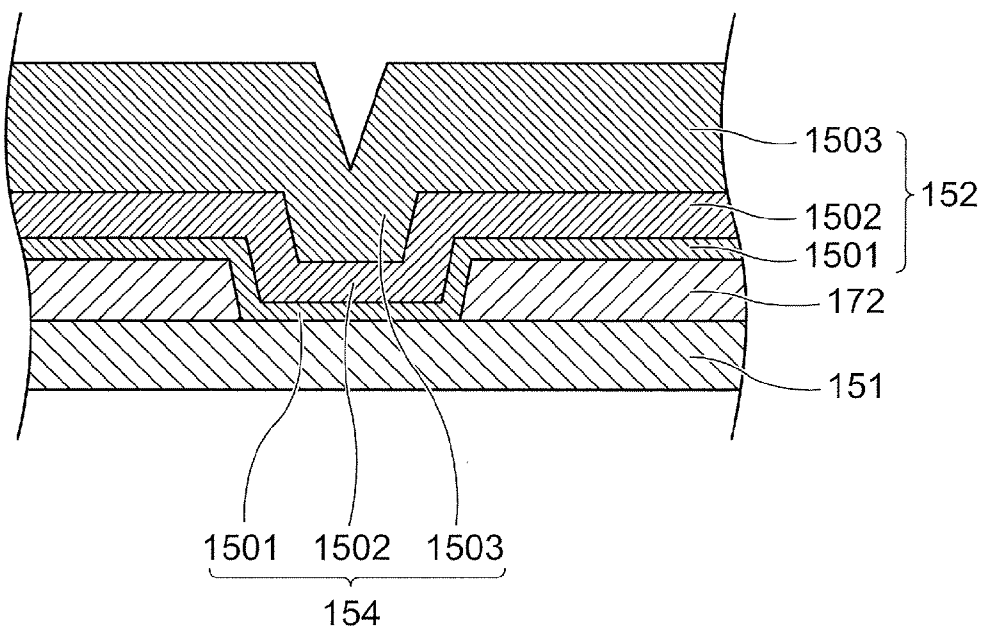


FIG.6

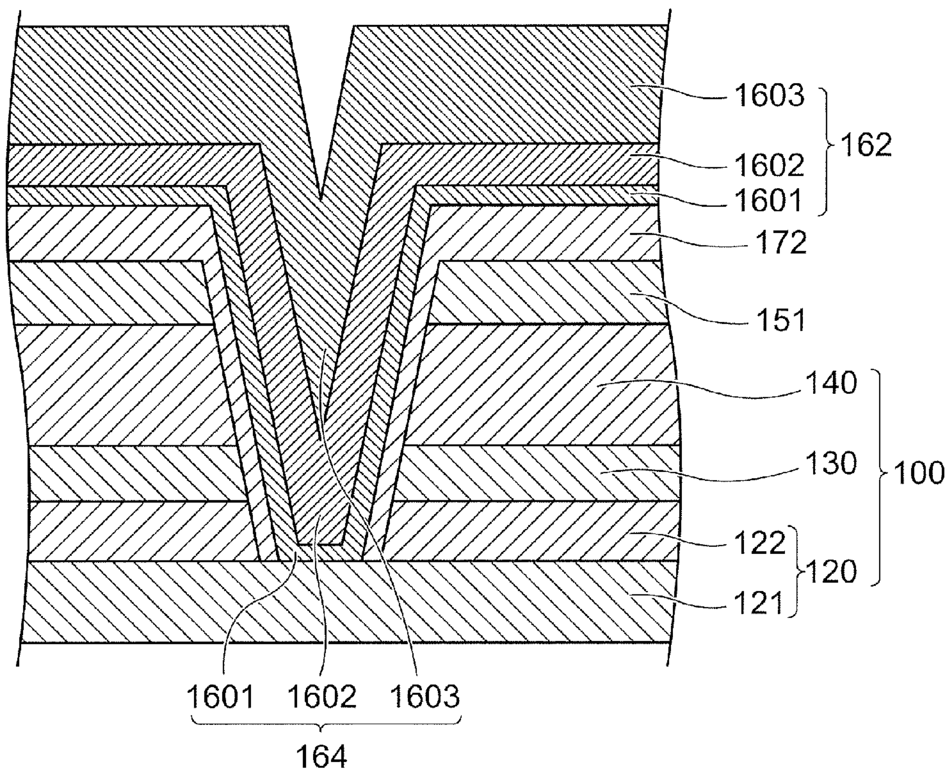

1603
162
1602
1601
172
151
140
130
100
122
120
121
1601
1602
1603
164

FIG.7

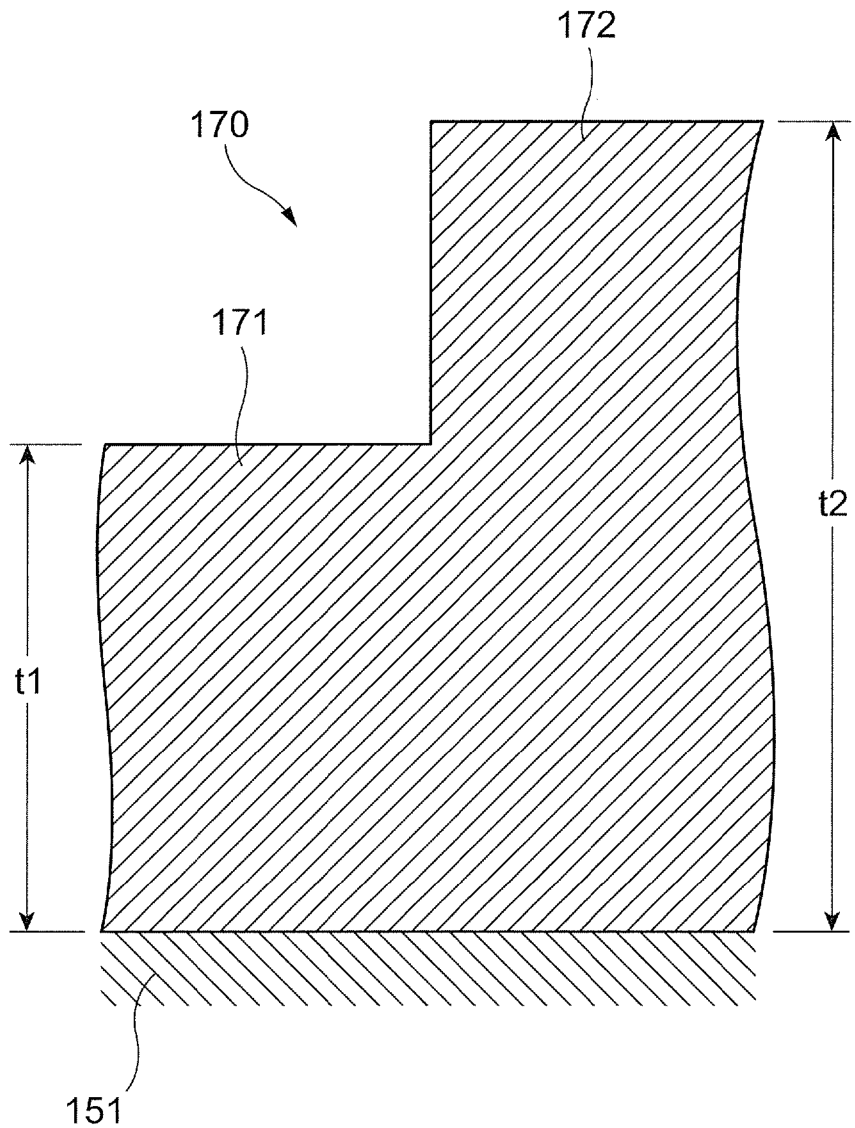


FIG.8A

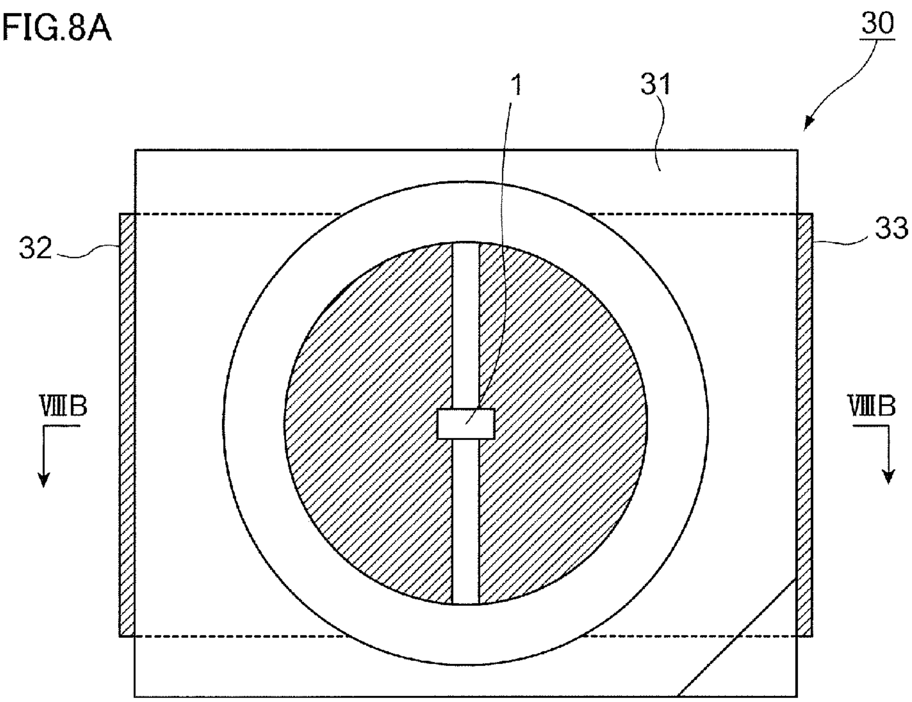
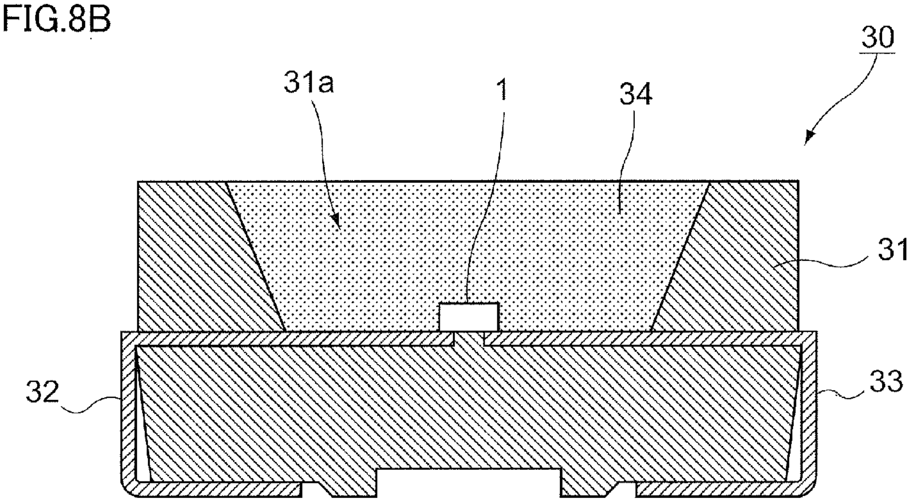



FIG.8B



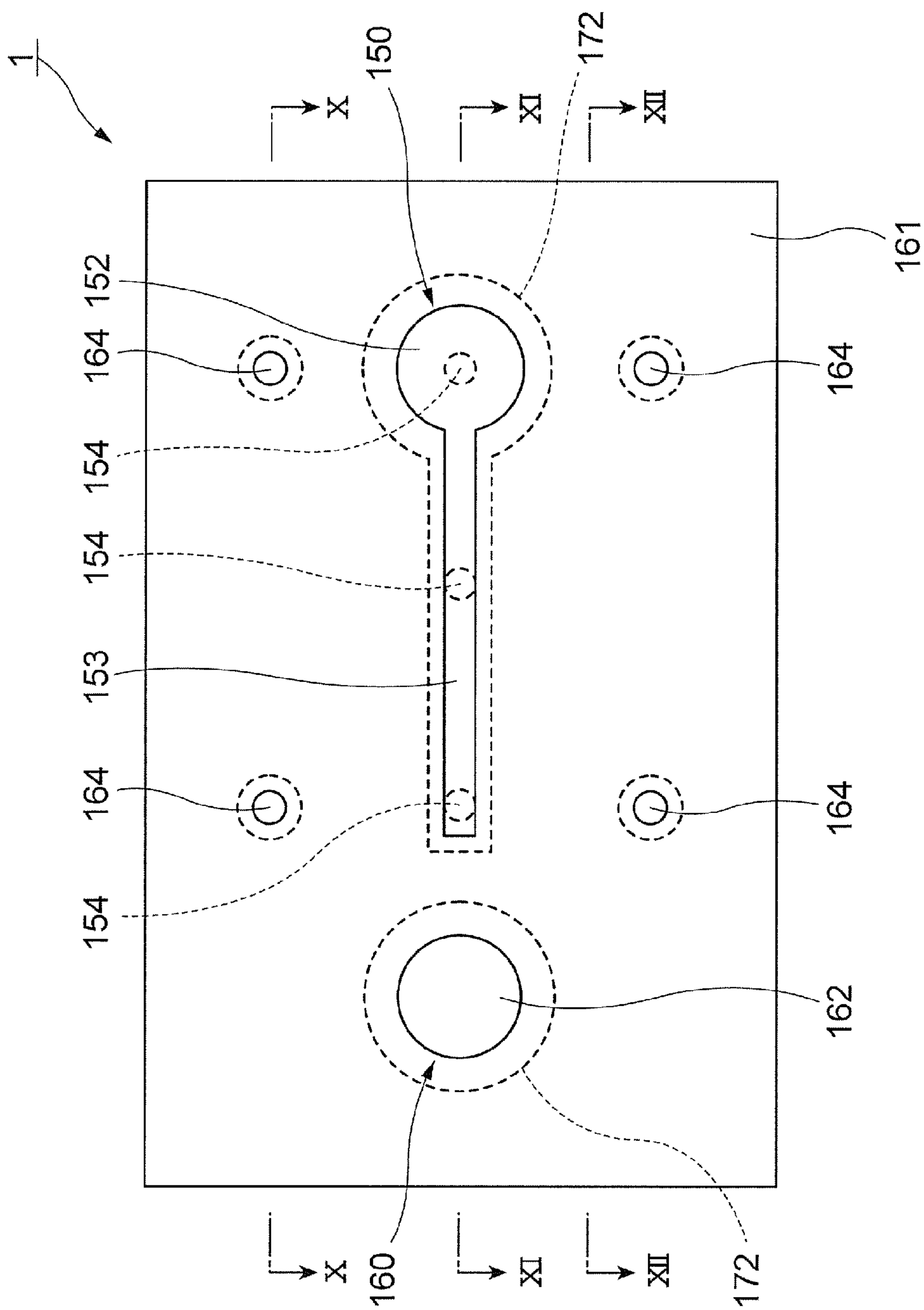



FIG.9

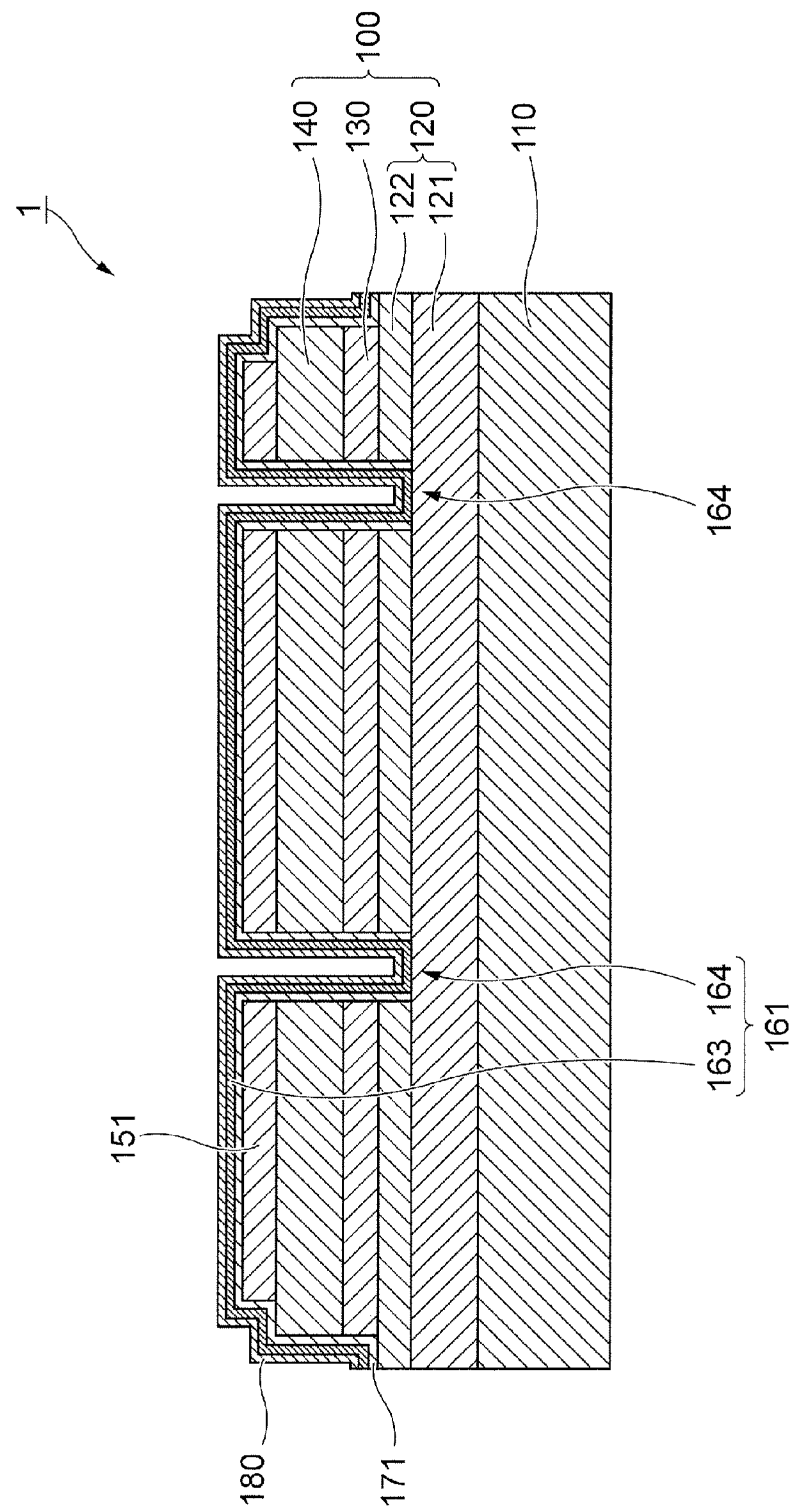
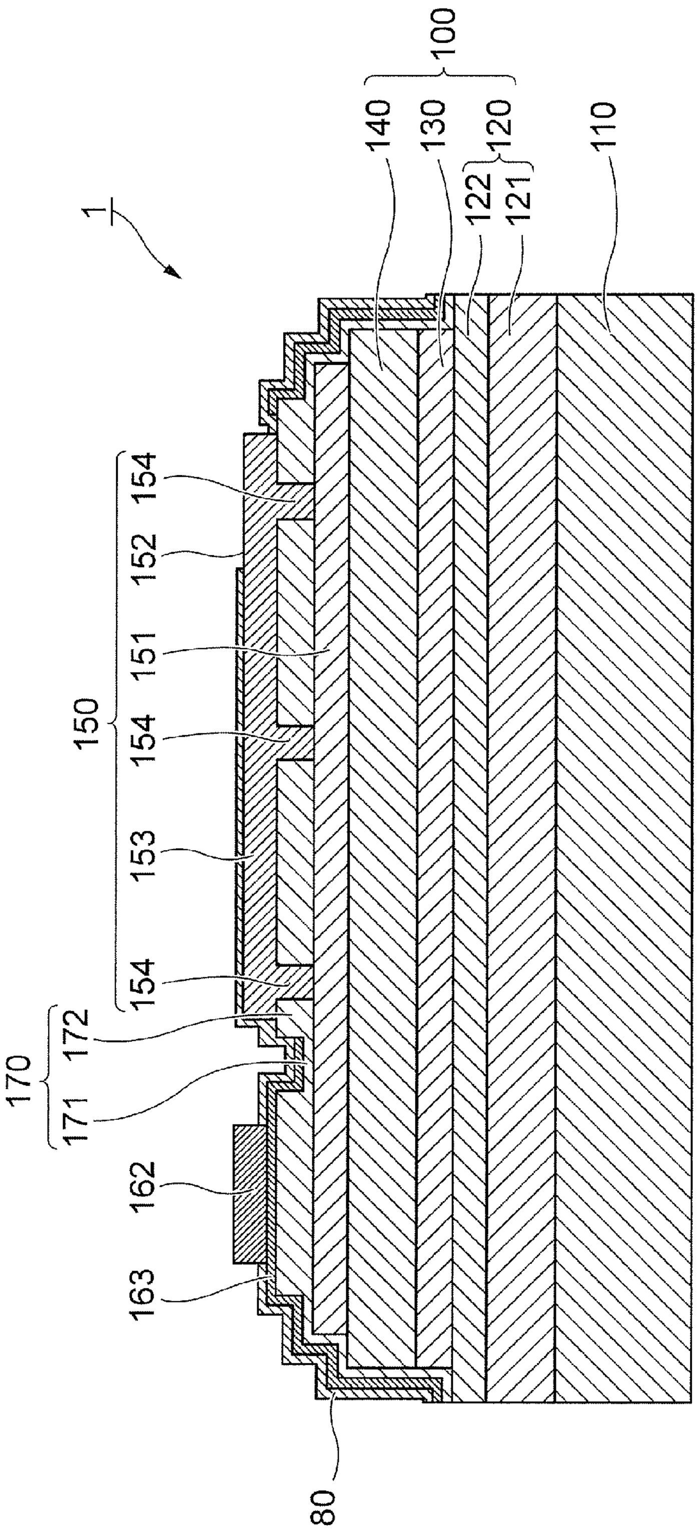



FIG.10



1
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140
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151
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170
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162
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180


FIG.11

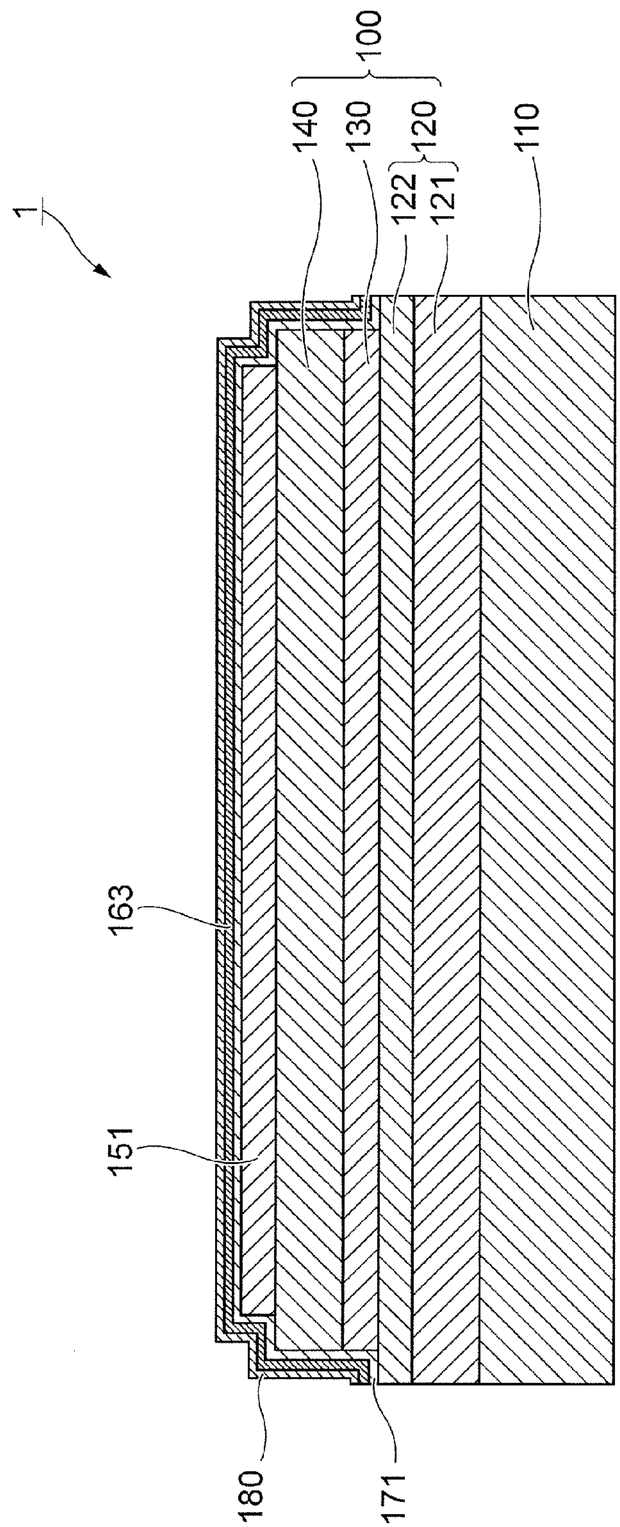



FIG.12

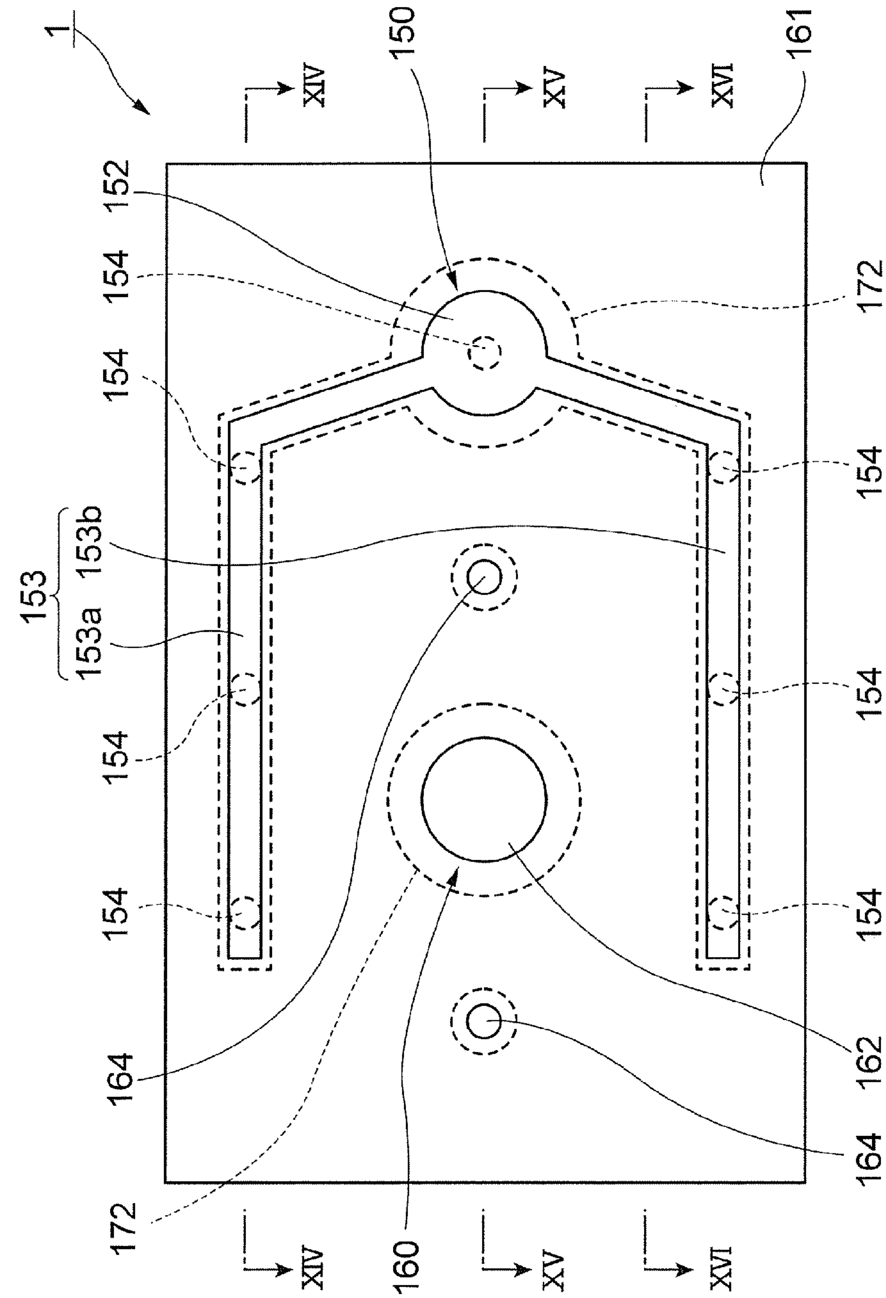
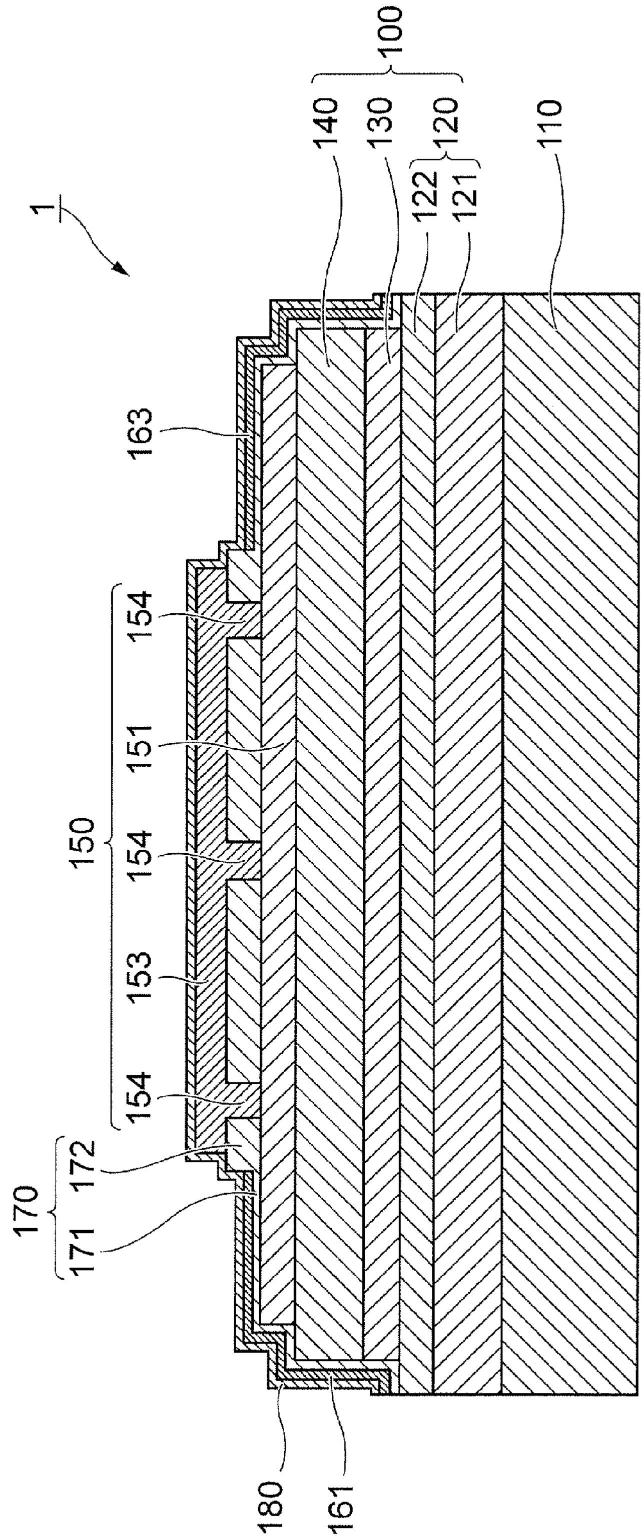



FIG.13


1
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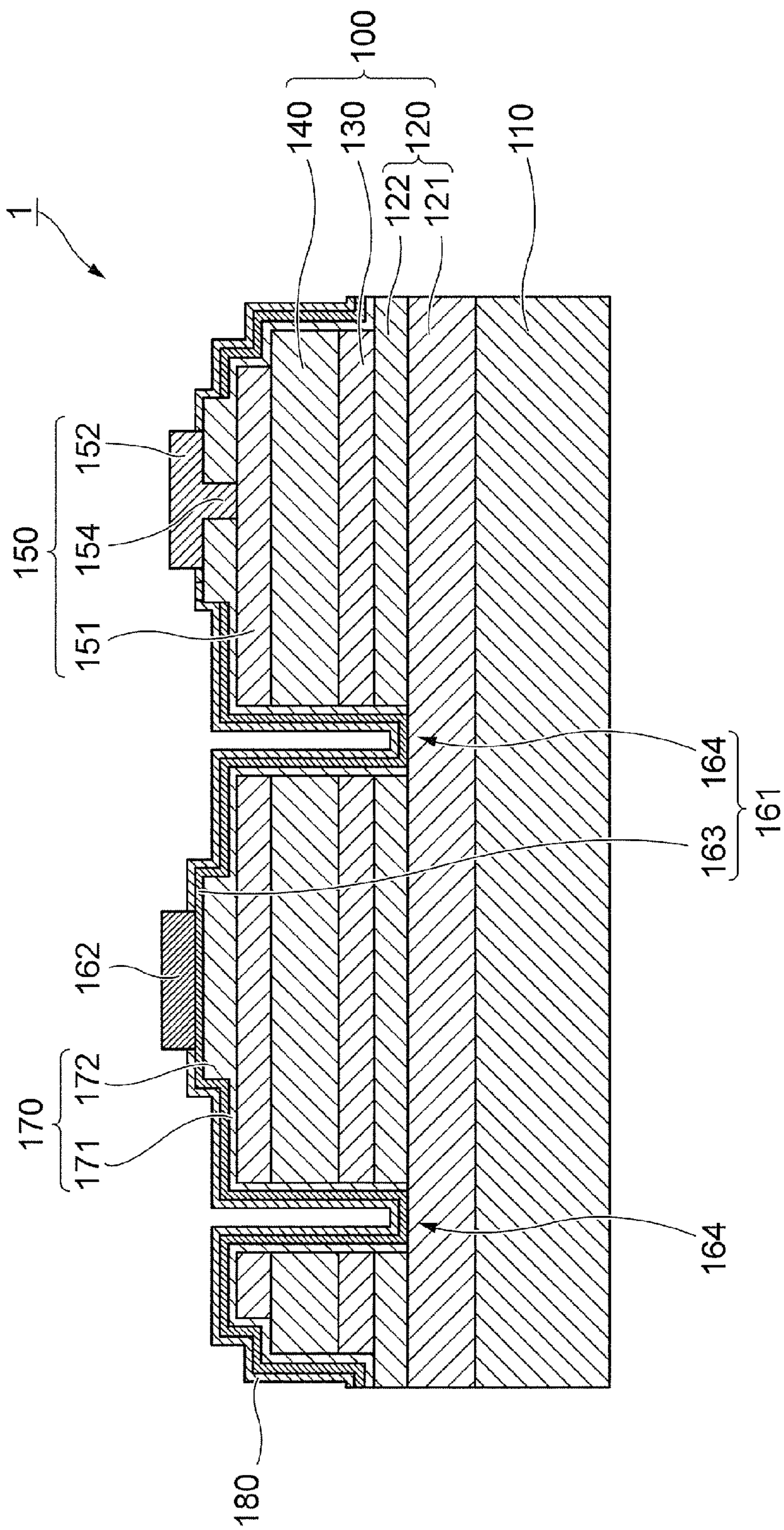
180
161

FIG.14


1
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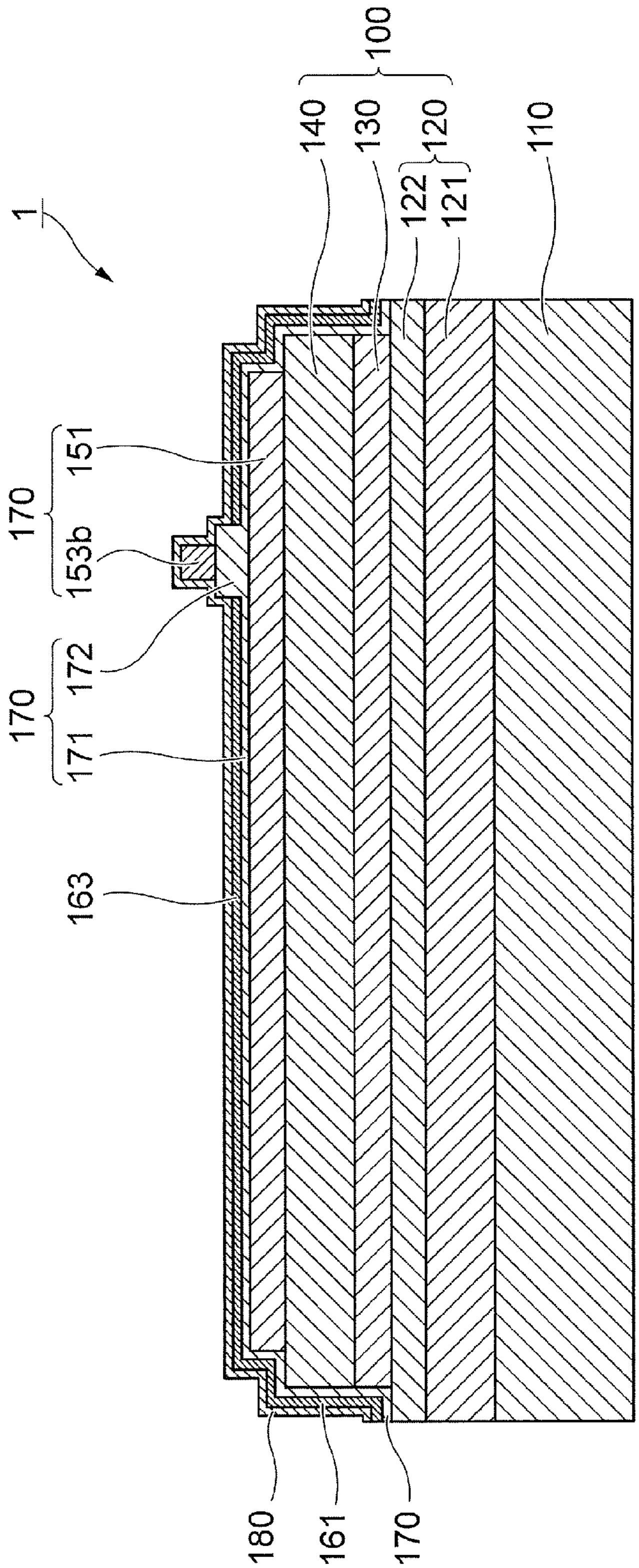
180

FIG.15



1
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140
130
120
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121
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153b
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163
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170


FIG.16

# SEMICONDUCTOR LIGHT EMITTING ELEMENT AND LIGHT EMITTING DEVICE

## CROSS REFERENCE TO RELATED APPLICATIONS

This application is based on and claims priority under 35 USC §119 from Japanese Patent Application No. 2012-235584 filed Oct. 25, 2012.

## BACKGROUND

1. Technical Field

The present invention relates to a semiconductor light emitting element and a light emitting device.

2. Related Art

A semiconductor light emitting element using a light emitting layer such as GaInN, AlInGaP, and GaAlAs is used as a light emitting diode having high efficiency of emitting light. For example, a semiconductor light emitting element using a group III nitride semiconductor such as GaN is configured by forming a group III nitride semiconductor layer including a light emitting layer on a substrate of, for example, sapphire. There are such semiconductor light emitting elements that emit light emitted from the light emitting layer to the outside by mounting the semiconductor light emitting element on a wiring board by face up.

As a conventional technique described in a gazette, there is a semiconductor light emitting element configured by forming p-electrode on a p-type semiconductor layer opposite to the substrate with laminating the n-type semiconductor layer, light emitting layer and the p-type semiconductor layer on the substrate, and forming n-electrode on a n-type semiconductor layer exposed opposite to the substrate by removing a part of the both of the p-type semiconductor layer and the light emitting layer (Japanese Patent Application Laid-Open Publication No. 2012-028495).

However, in the case of adopting the configuration of the semiconductor layer exposed by removing the both of the p-type semiconductor layer and the light emitting layer in order to form the n-electrode, as much as the area of the light emitting layer of the semiconductor light emitting element is decreased, there has been a possibility to reduce the light emission from the semiconductor light emitting element.

Also, in the case of adopting the configuration of providing the n-electrode on a part opposite to the light emitting layer without removing any one of the p-type semiconductor layer and the light emitting layer, the light emitted from the light emitting layer is absorbed by the n-electrode, as a result, there has been a possibility to become hard to increase the light emission from the semiconductor light emitting element.

An object of the present invention is to increase the light emission from the semiconductor light emitting element to be used by face up mounting.

## SUMMARY

According to an aspect of the present invention, there is provided a semiconductor light emitting element including: a first semiconductor layer that is composed of a compound semiconductor with a first conductive type; a light emitting layer that is provided on the first semiconductor layer to be contact with the first semiconductor layer, is composed of a compound semiconductor, and emits light with current flow; a second semiconductor layer that is provided on the light emitting layer to be contact with the light emitting layer and composed of a compound semiconductor with a second con-



ductive type different from the first conductive type; a first power supply electrode that is provided at a rear side of the second semiconductor layer in the view from the light emitting layer, is composed of metal, and electrically connected to the first semiconductor layer; a second power supply electrode that is provided at the rear side of the second semiconductor layer in the view from the light emitting layer, is composed of metal, and electrically connected to the second semiconductor layer; and a transparent insulating layer that is provided at the rear side of the second semiconductor layer in the view from the light emitting layer, is composed of materials having permeability to the light of a wavelength emitted from the light emitting layer, and electrically insulates the first power supply electrode and the second power supply electrode; wherein the transparent insulating layer includes; a first transparent insulating portion that is set to have a first thickness with which the light emitted from the light emitting layer is easily transmitted, and is provided on portions at the rear side of the second semiconductor layer in the view from the light emitting layer where the first power supply electrode and the second power supply electrode are not provided; and a second transparent insulating portion that is set to have a second thickness with which the light emitted from the light emitting layer is easily reflected, and is provided on portions between the second semiconductor layer and the first power supply electrode and on portions between the second semiconductor layer and the second power supply electrode.

Such a semiconductor light emitting element further includes a first connective electrode that is electrically connected to the first semiconductor layer through a hole penetrating the transparent insulating layer, the second semiconductor layer and the light emitting layer; and a first auxiliary electrode that is provided at the rear side of the second semiconductor layer in the view from the light emitting layer and electrically connects the first connective electrode and the first power supply electrode.

Moreover, the first auxiliary electrode is composed of metals, and the second transparent insulating portion is provided between the second semiconductor layer and the first auxiliary electrode.

Further, the first connective electrode and the first auxiliary electrode are composed of transparent conductive materials having electronic conductivity and permeability to the light emitted from the light emitting layer.

Still further, the compound semiconductor is composed of a group III nitride semiconductor, and the first semiconductor layer is laminated on a substrate directly or through other layer.

According to another aspect of the present invention, there is provided a light emitting device including: a base portion in which a first wiring and a second wiring are formed; and a semiconductor light emitting element that is connected to the base portion by face up, wherein the semiconductor light emitting element includes; a first semiconductor layer that is composed of a compound semiconductor with a first conductive type; a light emitting layer that is provided on the first semiconductor layer to be contact with the first semiconductor layer, is composed of a compound semiconductor, and emits light with current flow; a second semiconductor layer that is provided on the light emitting layer to be contact with the light emitting layer and composed of a compound semiconductor with a second conductive type different from the first conductive type; a first power supply electrode that is provided at a rear side of the second semiconductor layer in the view from the light emitting layer, is composed of metal, electrically connected to the first semiconductor layer, and electrically connected to the first wiring provided on the base portion; a second power supply electrode that is provided at the rear side of the second semiconductor layer in the view from the light emitting layer, is composed of metal, electrically connected to the second semiconductor layer, and electrically connected to the second wiring provided on the base portion; and a transparent insulating layer that is provided at the rear side of the second semiconductor layer in the view from the light emitting layer, composed of materials having permeability to the light of a wavelength emitted from the light emitting layer, and electrically insulates the first power supply electrode and the second power supply electrode; wherein the transparent insulating layer includes; a first transparent insulating portion that is set to have a first thickness with which the light emitted from the light emitting layer is easily transmitted, and is provided on portions at the rear side of the second semiconductor layer in the view from the light emitting layer where the first power supply electrode and the second power supply electrode are not provided; and a second transparent insulating portion that is set to have a second thickness with which the light emitted from the light emitting layer is easily reflected, and is provided on portions between the second semiconductor layer and the first power supply electrode and on portions between the second semiconductor layer and the second power supply electrode.

According to the present invention, it is possible to increase the light emission from the semiconductor light emitting element to be used by face up mounting.

## BRIEF DESCRIPTION OF THE DRAWINGS

An exemplary embodiment of the present invention will be described in detail based on the following figures, wherein:

FIG. **1** is a diagram showing specific example of an upper surface of a semiconductor light emitting element according to the first exemplary embodiment;

FIG. **2** is a II-II cross-sectional view in FIG. **1**;

FIG. **3** is a III-III cross-sectional view in FIG. **1**;

FIG. **4** is a IV-IV cross-sectional view in FIG. **1**;

FIG. **5** is a diagram showing a specific example of a configuration of the p-side power supply portion of a semiconductor light emitting element according to the first exemplary embodiment;

FIG. **6** is a diagram showing a specific example of a configuration of the n-side power supply portion of a semiconductor light emitting element according to the first exemplary embodiment;

FIG. **7** is a diagram showing a specific example of a configuration of the power supply insulating layer;

FIGS. **8**A and **8**B are diagrams showing specific examples of a configuration of the light emitting device on which the semiconductor light emitting element is mounted;

FIG. **9** is a diagram showing a specific example of an upper surface of a semiconductor light emitting element according to the second exemplary embodiment;

FIG. **10** is a X-X cross-sectional view in FIG. **9**;

FIG. **11** is a XI-XI cross-sectional view in FIG. **9**;

FIG. **12** is a XII-XII cross-sectional view in FIG. **9**;

FIG. **13** is a specific example of an upper surface of a semiconductor light emitting element according to the third exemplary embodiment;

FIG. **14** is a XIV-XIV cross-sectional view in FIG. **13**;

FIG. **15** is a XV-XV cross-sectional view in FIG. **13**; and

FIG. **16** is a XVI-XVI cross-sectional view in FIG. **13**.

## DETAILED DESCRIPTION

Hereinafter, an exemplary embodiment according to the present invention will be described in detail with reference to accompanying drawings. It should be noted that there are some cases where a size or a thickness of each component in the drawings that are referred to in the following description is different from a dimension of an actual semiconductor light emitting element and the like.

### First Exemplary Embodiment

FIG. **1** is a diagram showing specific example of an upper surface of a semiconductor light emitting element **1** according to the first exemplary embodiment. FIG. **2** is a II-II cross-sectional view in FIG. **1**, FIG. **3** is a III-III cross-sectional view in FIG. **1**, and FIG. **4** is a IV-IV cross-sectional view in FIG. **1**. Here, for example, the semiconductor light emitting element **1** of the present exemplary embodiment is rectangular in shape in the view from top side like shown in FIG. **1**, the vertical direction of FIG. **1** is the short edge side and the cross direction of FIG. **1** is the long edge side. It should be noted that in the following description the vertical direction is referred to as the short direction and the cross direction is referred to as the longitudinal direction.

(Semiconductor Light Emitting Element)

The semiconductor light emitting element **1** of the present exemplary embodiment includes: a substrate **110**; an n-type semiconductor layer **120** laminated on the substrate **110**; a light emitting layer **130** laminated on the n-type semiconductor layer **120**; and a p-type semiconductor layer **140** laminated on the light emitting layer **130**. It should be noted that, in the following description, these n-type semiconductor layer **120**, light emitting layer **130**, and p-type semiconductor layer **140** will be collectively referred to as a laminated semiconductor layer **100** in some cases as necessary. Moreover, an intermediate layer (not shown in the figures) or a base layer (not shown in the figures) may be provided between the substrate **110** and the n-type semiconductor layer **120** as necessary.

Here, the n-type semiconductor layer **120** includes an n-contact layer **121** laminated on the substrate **110** and an n-cladding layer **122**, which is laminated on the n-contact layer **121** and on which the light emitting layer **130** is laminated. Although details are not described here, it should be noted that the p-type semiconductor layer **140** may be configured to include a p-type cladding layer (not shown in the figures) laminated on the light emitting layer **130** and a p-type contact layer laminated on the p-type cladding layer.

Moreover, the semiconductor light emitting element **1** includes; a p-side power supply portion **150** electrically connected to the p-type semiconductor layer **140**, and an n-side power supply portion **160** electrically connected to the n-type semiconductor layer **120**. Further, between the p-side power supply portion **150** and the n-side power supply portion **160**, the semiconductor light emitting element **1** includes; a power supply insulating layer **170** to electrically insulate the p-side power supply portion **150** and the n-side power supply portion **160** each other, and a protective insulating layer **180** that protects the light emitting layer **130** and the like from water which goes into inside of the semiconductor light emitting element **1** from outside and that electrically insulates the p-side power supply portion **150** and the n-side power supply portion **160** each other. It should be noted that, in FIG. **1**, the description of the protective insulating layer **180** is omitted, which is actually positioned at an uppermost layer (at the most front side)

Here, the p-side power supply portion **150** includes; a p-side transparent conductive layer **151** which is laminated on the p-type semiconductor layer **140** and on which the power supply insulating layer **170** is laminated; a p-side power supply electrode **152** and a p-side auxiliary electrode **153** which are laminated on the power supply insulating layer **170**; and plural p-side connective electrodes **154** (in this exemplary embodiment, seven) that electrically connect the p-side transparent conductive layer **151** with any one of the p-side power supply electrode **152** and the p-side auxiliary electrode **153** via holes penetrating through the power supply insulating layer **170**.

In the p-side power supply portion **150** of the present exemplary embodiment, the p-side transparent conductive layer **151** is formed to cover the almost whole upper surface of the p-type semiconductor layer **140** except for peripheries thereof.

Moreover, in the p-side power supply portion **150** of the present exemplary embodiment, the p-side power supply electrode **152** as an example of a second power supply electrode is, on the top surface of the semiconductor light emitting element **1**, arranged at one edge side in the longitudinal direction (the right side in FIG. **1**) and at a center portion in the short direction, and has a circular shape in the view from top surface side. The protective insulating layer **180** is not laminated on the top surface of the p-side power supply electrode **152** (for example, refer to FIG. **3**), and the p-side power supply electrode **152** is exposed outside. The p-side power supply electrode **152** is used for electronic connect to outside by using a not-shown bonding wire and the like.

Furthermore, in the p-side power supply portion **150** of the present exemplary embodiment, the p-side auxiliary electrode **153** includes: an L-shaped p-side first auxiliary electrode **153***a* which is integrated with the p-side power supply electrode **152** at the side of one edge and extends along the longitudinal direction of the semiconductor light emitting element **1** at the other edge side; and an L-shaped p-side second auxiliary electrode **153***b* which is integrated with the p-side power supply electrode **152** at the side of one edge and extends along the longitudinal direction of the semiconductor light emitting element **1** at the side of the other edge. Here, in the present exemplary embodiment, the p-side first auxiliary electrode **153***a* and the p-side second auxiliary electrode **153***b* do not make direct contact with each other by providing the p-side first auxiliary electrode **153***a* at the side of one edge in the short direction of the semiconductor light emitting element **1** (at the side of the upper part in FIG. **1**) and the p-side second auxiliary electrode **153***b* at the side of the other edge in the short direction of the semiconductor light emitting element **1** (at the side of the lower part FIG. **1**). The protective insulating layer **180** is laminated on the top surfaces of the p-side first auxiliary electrode **153***a* and the p-side second auxiliary electrodes **153***b* (for example, refer to FIG. **2** and FIG. **4**). Also, in the present exemplary embodiment, one p-side connective electrode **154** is provided at the lower side of the p-side power supply electrode **152**, three p-side connective electrodes **154** are provided at the lower side of the p-side first auxiliary electrode **153***a*, and three p-side connective electrodes **154** are provided at the lower side of the p-side second auxiliary electrode **153***b*, respectively.

On the other hand, the n-side power supply portion **160** includes; an n-side power supply electrode **162** and an n-side auxiliary electrode **163** which are laminated on the power supply insulating layer **170**, and plural n-side connective electrodes **164** (in this exemplary embodiment, three) that electrically connect the n-contact layer **121** of the n-type semiconductor layer **120** with any one of the n-side power supply electrode **162** and the n-side auxiliary electrode **163** via holes penetrating through the p-side transparent conductive layer **151** of the p-side power supply portion **150**, the p-type semiconductor layer **140**, the light emitting layer **130**, and the n-cladding layer **122** of the n-type semiconductor layer **120**.

In the n-side power supply portion **160** of the present exemplary embodiment, the n-side power supply electrode **162** as an example of a first power supply electrode is, on the top surface of the semiconductor light emitting element **1**, arranged at the other edge side in the longitudinal direction (the left side in FIG. **1**) and at a center portion in the short direction, and has a circular shape in the view from top surface side. The protective insulating layer **180** is not laminated on the top surface of the n-side power supply electrode **162** (for example, refer to FIG. **3**), and the n-side power supply electrode **162** is exposed outside. The n-side power supply electrode **162** is used for electronic connect to outside by using a not-shown bonding wire and the like.

Moreover, in the n-side power supply portion **160** of the present exemplary embodiment, one n-side auxiliary electrode **163** as an example of a first auxiliary electrode that is integrated with the n-side power supply electrode **162** at the side of one edge and extends along the longitudinal direction of the semiconductor light emitting element **1** at the side of the other edge toward the p-side power supply electrode **152** is provided. Thus the n-side auxiliary electrode **163** is provided in the area between the p-side first auxiliary electrode **153***a* and the p-side second auxiliary electrode **153***b* in the p-side power supply portion **150**. The protective insulating layer **180** is laminated on the top surface of the n-side auxiliary electrode **163** (for example, refer to FIG. **3**). Also in the present exemplary embodiment, one n-side connective electrode **164** is provided at the lower side of the n-side power supply electrode **162**, and the two n-side connective electrodes **164** are provided at the lower side of the n-side auxiliary electrode **163** respectively.

Here, the above-described power supply insulating layers **170** are provided at the respective side walls of plural holes provided to correspond to the respective n-side connective electrodes **164** as an example of a first connective electrode. Therefore, the respective n-side connective electrodes **164** do not make direct contact with at least the p-side transparent conductive layer **151**, p-type semiconductor layer **140**, and the light emitting layer **130**. On the other hand, the power supply insulating layers **170** are not provided on the respective lower edge portions in the plural holes and the respective n-side connective electrodes **164** and the n-contact layer **121** are directly contacted.

In the present exemplary embodiment, for instance, in the view of the top surface side as shown in FIG. **1**, two p-side connective electrodes **154** and one n-side connective electrode **164** are provided to form a shape of a triangular, or the one p-side connective electrode **154** and the two n-side connective electrodes **164** are provided to form a shape of a triangular. It should be noted that in the semiconductor light emitting element **1**, the positions of the p-side power supply portion **150** (p-side transparent conductive layer **151**, p-side power supply electrode **152**, p-side auxiliary electrode **153** and the p-side connective electrode **154**) and the n-side power supply portion **160** (n-side power supply electrode **162**, n-side auxiliary electrode **163** and n-side connective electrode **164**) are decided not to be directly contact each other.

Moreover, the power supply insulating layer **170** includes: a thick-film portion **172** provided on the portion at the lower side of the p-side power supply electrode **152** and the p-side auxiliary electrode **153** which configure the p-side power supply portion **150**, and also on the portion at the lower side of the n-side power supply electrode **162** and the n-side auxiliary electrode **163** which configure the n-side power supply portion **160**; and a thin-film portion **171** that is provided on the portions except for the thick-film portions **172** and has a thickness thinner than that of the thick-film portion **172**. It should be noted that the relationship between the thin-film portion **171** and the thick-film portion **172** in the power supply insulating layer **170** will be described below.

Further, the protective insulating layer **180** covers the upper surface of the semiconductor light emitting layer **1**, except for the p-side power supply electrode **152** of the p-side power supply portion **150** and the n-side power supply electrode **162** of the n-side power supply portion **160**.

It should be noted that, in the semiconductor light emitting layer **1** of the present exemplary embodiment, as shown in FIG. **2** to FIG. **4**, the power supply insulating layer **170** and the protective insulating layer **180** cover the side surfaces of the light emitting layer **130** and the p-type semiconductor layer **140**.

In the semiconductor light emitting element **1**, the light emitting layer **130** is configured to emit light by setting the p-side power supply electrode **152** of the p-side power supply portion **150** as a positive electrode and the n-side power supply electrode **162** of the n-side power supply portion **160** as a negative electrode to flow a current from the p-side power supply electrode **152** to the n-side power supply electrode **162**.

The semiconductor light emitting element **1** of the present exemplary embodiment is a light emitting diode of a face-up type in which light emitted from the light emitting layer **130** is extracted from the side on which the p-side power supply portion **150** and the n-side power supply portion **160** are formed. Here, in the semiconductor light emitting element **1** of the present exemplary embodiment, the p-side transparent conductive layer **151**, the p-side power supply electrode **152**, p-side auxiliary electrode **153** and the p-side connective electrode **154** which configure the p-side power supply portion **150**, and the n-side power supply electrode **162** and the n-side auxiliary electrode **163** which configure the n-side power supply portion **160** are provided in the inner side beyond the p-type semiconductor layer **140** in the view from the light emitting layer **130**. In another point of view, in the semiconductor light emitting element **1** of the present exemplary embodiment, the light emitting layer **130** is provided at the lower side of the p-side transparent conductive layer **151**, p-side power supply electrode **152**, p-side auxiliary electrode **153**, and the p-side connective electrode **154** which configure the p-side power supply portion **150**, and at the lower side of the n-side power supply electrode **162** and the n-side auxiliary electrode **163** which configure the n-side power supply portion **160** (however, except for the lower side of the forming portion of the n-side connective electrode **164**).

Next, each component of the semiconductor light emitting element **1** will be described in more detail with reference to FIG. **1** to FIG. **4**.

It should be noted that, in the following description, AlGaN, GaN and GaInN as specific examples of a compound semiconductor and a group III nitride semiconductor are described with the compositional ratio of each element being omitted in some cases.

<Substrate>

The substrate **110** can be selected to be used from various kinds of substrate materials without any limitation as long as group III nitride semiconductor crystals are epitaxially grown on a surface thereof. For example, substrate materials composed of sapphire, SiC, GaN, silicon or the like can be used.

Moreover, among the above-described materials, a transparent substrate is preferable, and in particular, it is preferable to use sapphire whose chamfer is a principal surface as the substrate **110** in view of quality and cost. In the case of using sapphire as the substrate **110**, it is preferable to configure an intermediate layer (a buffer layer) by processing the surface to rough on the C-plate surface of sapphire.

<Intermediate Layer>

The intermediate layer is preferably composed of polycrystal $Al_xGa_{1-x}N$ ($0 \le x \le 1$), and more preferably, composed of single crystal $Al_xGa_{1-x}N$ ($0 \le x \le 1$). For example, the intermediate layer can be composed of polycrystal $Al_xGa_{1-x}N$ ($0 \le x \le 1$) with a thickness of 10 nm to 500 nm. It should be noted that the intermediate layer has a function of mediating the difference in lattice constant between the substrate **110** and the base layer described later to facilitate the formation of a single crystal layer which is c-axis oriented on the (0001) surface (chamfer) of the substrate **110**. Therefore, the laminated semiconductor layer **100** having more excellent crystallinity can be obtained by laminating the single crystal base layer on the intermediate layer.

<Base Layer>

As the base layer, $Al_xGa_yIn_zN$ ($0 \le x \le 1$, $0 \le y \le 1$, $0 \le z \le 1$, $x+y+z=1$) can be used, but it is preferable to use $Al_xGa_{1-x}N$ ($0 \le x \le 1$) because the base layer with excellent crystallinity can be formed.

The thickness of the base layer **130** is preferably 0.1 μm or more. The $Al_xGa_yIn_zN$ layer having excellent crystallinity is likely to be obtained with these layer thickness or more. The base layer preferably has the thickness which can flatten the rough of the above-described rough processed substrate. Furthermore, the thickness of the base layer is preferably 10 μm or less.

<Laminated Semiconductor Layer>

The laminated semiconductor layer **100** including a group III nitride semiconductor is configured by laminating the n-type semiconductor layer **120**, the light emitting layer **130**, and the p-type semiconductor layer **140** on the substrate **110** in this order as shown in FIG. **2** to FIG. **4**. Each layer of the n-type semiconductor layer **120**, the light emitting layer **130**, and the p-type semiconductor layer **140** may be configured by plural semiconductors.

Here, the n-type semiconductor layer **120** as an example of a first semiconductor layer performs electric conduction by setting an electron is a carrier, while the p-type semiconductor layer **140** as an example of a second semiconductor layer performs electric conduction by setting a hole is a carrier. In this exemplary embodiment, the n-type in which an electron is a carrier corresponds to the first conductive type, while the p-type in which a hole is a carrier corresponds to the second conductive type.

<N-Type Semiconductor Layer>

The n-type semiconductor layer **120** includes the n-contact layer **121** laminated on the substrate **110** (the base layer in this exemplary embodiment) and the n-cladding layer **122**, which is laminated on the n-contact layer **121**. The n-contact layer **121** can serve as the n-cladding layer **122**. It should be noted that the above-described base layer may be included in the n-type semiconductor layer **120**.

Of these, the n-contact layer **121** is a layer for providing the n-side power supply portion **160** (more specifically, the n-side connective electrodes **164**). The intermediate layer is preferably composed of polycrystal $Al_xGa_{1-x}N$ layer ($0 \le x \le 1$, preferably $0 \le x \le 0.5$, more preferably $0 \le x \le 0.1$) may be used as the n-contact layer **121**.

The n-cladding layer **122** performs injection of the carriers (the electrons here) into the light emitting layer **130** and confinement of the carriers. In the present exemplary embodiment, the n-cladding layer **122** can be formed of AlGaN, GaN, GaInN and the like. Further, the hetero junction structure or the superlattice structure in which the layer is laminated plural times of these structures may also be used. When the n-cladding layer **122** is formed of GaInN, the band gap thereof is preferably larger than that of GaInN of the light emitting layer **130** described later.

It should be noted that, in the case where the n-cladding layer **122** is a layer containing the superlattice structure, the layer may contain a structure in which an n-side first cladding layer composed of the group III nitride semiconductor with a thickness of 10 nm or less and an n-side second cladding layer having a different composition from the n-side first cladding layer and composed of the group III nitride semiconductor with a thickness of 10 nm or less are laminated.

Further, the n-cladding layer **122** may contain a structure in which the n-side first cladding layers and the n-side second cladding layers are alternately and repeatedly laminated, and the structure is preferably an alternating structure of GaInN and GaN or an alternating structure of GaInN having different compositions.

<Light Emitting Layer>

As the light emitting layer **130**, a single quantum well structure or a multiple quantum well structure can be employed.

As a well layer having a quantum well structure, the group III nitride semiconductor layer composed of $Ga_{1-y}In_yN$ ($0<y<0.4$) is usually used. The thickness of the well layer may be the thickness by which quantum effects can be obtained, for example, 1 nm to 10 nm, and is preferably 2 nm to 6 nm in terms of light emission output.

Moreover, in the case of the light emitting layer **130** having the multiple quantum well structure, the above-described $Ga_{1-y}In_yN$ is employed as the well layer, and $Al_zGa_{1-z}N$ ($0\leq z<0.3$) having a band gap energy larger than that of the well layer is employed as a barrier layer. The well layer and the barrier layer may be doped or not doped with impurities depending upon a design thereof.

<P-Type Semiconductor Layer>

The p-type semiconductor layer **140** is preferably configured with the p-cladding layer laminated on the light emitting layer **130** and the p-contact layer laminated on the p-cladding layer. The p-contact layer can also serve as the p-cladding layer.

The p-cladding layer performs confinement of carriers (here, holes) within the light emitting layer **130** and injection of carriers. The p-cladding layer is not particularly limited as long as the band gap energy of the composition thereof is larger than that of the light emitting layer **130** and carriers can be confined within the light emitting layer **130**, but is preferably composed of $Al_xGa_{1-x}N$ ($0<x\leq 0.4$).

It is preferable that the p-cladding layer is composed of such AlGaN in terms of confinement of carriers within the light emitting layer **130**. The thickness of the p-cladding layer is not particularly limited, but preferably 1 nm to 400 nm, and more preferably 5 nm to 100 nm.

Further, similarly to the above-described n-cladding layer **122**, the p-cladding layer may have a superlattice structure in which the layer is laminated plural times of these structures, and preferably has an alternating structure of AlGaN and AlGaN with different composition or an alternating structure of AlGaN and GaN.

The p-contact layer is a layer for providing the p-side power supply portion **150** (specifically, the p-side transparent conductive layer **151**). The p-contact layer is preferably composed of $Al_xGa_{1-x}N$ ($0\leq x\leq 0.4$). It is preferable that Al composition is in the above-described range in terms of allowing to maintain excellent crystallinity and good ohmic contact with the p-side transparent conductive layer **151**.

The thickness of the p-contact layer is not particularly limited, but is preferably 10 nm to 500 nm, and more preferably 50 nm to 200 nm. It is preferable to provide the thickness of the p-contact layer in these ranges in the point that the forward voltage Vf can be reduced.

<P-Side Power Supply Portion **150**>

FIG. **5** is a diagram showing specific example of a configuration of the p-side power supply portion **150** according to the first exemplary embodiment. Here, FIG. **5** shows an enlarged cross-sectional view of a region V shown in FIG. **3**, that is, an interface portion between the p-side power supply electrode **152** and the p-side connective electrode **154**. It should be noted that the p-side auxiliary electrode **153** which configures the p-side power supply portion **150** together with the p-side power supply electrode **152** and the p-side connective electrode **154**, and the p-side connective electrode **154** provided at the side of the p-side auxiliary electrode **153** (refer to FIG. **2**) have the configuration in common.

[P-Side Transparent Conductive Layer]

The p-side transparent conductive layer **151** is formed to cover almost of all but an edge portion of the top surface of the p-type semiconductor layer **140**.

As the p-side transparent conductive layer **151**, it is preferable to employ those that can make an ohmic contact with the p-type semiconductor layer **140** and has small contact resistance with the p-type semiconductor layer **140**. Further, in the semiconductor light emitting element **1**, since the light from the light emitting layer **130** is emitted to the protective insulating layer **180** side via the p-side transparent conductive layer **151**, it is preferable to employ those having excellent optical permeability as the p-side transparent conductive layer **151**. Still further, for uniformly passing a current over the entire surface of the p-type semiconductor layer **140**, it is preferable to use the p-side transparent conductive layer **151** having excellent conductivity and narrow resistance distribution.

It should be noted that the thickness of the p-side transparent conductive layer **151** can be selected from the range of 2 nm to 500 nm. Here, if the thickness of the p-side transparent conductive layer **151** is less than 2 nm, there are some cases where an ohmic contact with the p-type semiconductor layer **140** is hardly available, and if the thickness of the p-side transparent conductive layer **151** is more than 500 nm, there are some cases that are not preferable in terms of optical permeability to the light emitted from the light emitting layer **130**.

As the p-side transparent conductive layer **151**, for example, an oxide conductive material having excellent optical permeability to the light of a wavelength emitted from the light emitting layer **130** is used. The optical permeability to the light of a wavelength emitted from the light emitting layer **130** is preferably 90% or more, and desirably 95% or more. In particular, part of oxides containing In is preferable in the point that both optical permeability and conductivity thereof are superior to other transparent conductive films. Examples of conductive oxides containing In include: IZO (indium zinc oxide ($In_2O_3$—ZnO)); ITO (indium tin oxide ($In_2O_3$—$SnO_2$)); IGO (indium gallium oxide ($In_2O_3$—$Ga_2O_3$)); and ICO (indium cerium oxide ($In_2O_3$—$CeO_2$)). It should be noted that a dopant such as fluorine may be added to these materials. Further, for example, oxides not containing In, such as carrier-doped $SnO_2$, $ZnO_2$ and $TiO_2$ may be employed.

The p-side transparent conductive layer **151** can be formed by providing these materials by any well-known method in this technical field. Moreover, by performing thermal annealing after forming the p-side transparent conductive layer **151** to promote crystallization, the optical permeability of the p-side transparent conductive layer **151** is improved and sheet resistance is reduced, thereby an ohmic contact is likely to be obtained.

In the exemplary embodiment, as the p-side transparent conductive layer **151**, those having a crystallized structure may be used, and in particular, a transparent material containing $In_2O_3$ crystals having a crystal structure of a hexagonal system or a bixbyite structure (for example, IZO or ITO) can be preferably used.

Further, as the film used for the p-side transparent conductive layer **151**, it is preferable to use a composition showing the lowest specific resistance. For example, a ZnO concentration in IZO is preferably 1% by mass to 20% by mass, and more preferably in a range of 5% by mass to 15% by mass, and 10% by mass is especially preferred.

Still further, in terms of increasing the contact property between the obtained films, the p-side transparent conductive layer **151** may be formed by sputtering method, for example.

[P-Side Power Supply Electrode, p-Side Auxiliary Electrode and p-Side Connective Electrode]

The p-side power supply electrode **152**, the p-side auxiliary electrode **153**, and the p-side connective electrode **154** in the p-side power supply portion **150** are configured by laminating a p-side first power supply layer **1501**, a p-side second power supply layer **1502**, and a p-side third power supply layer **1503** in the order of being adjacent to the p-side transparent conductive layer **151** to be connected with. In the present exemplary embodiment, the p-side first power supply layer **1501** is composed of TaN, the p-side second power supply layer **1502** is composed of Pt, and the p-side third power supply layer **1503** is composed of Au. The thickness of the p-side first power supply layer **1501** is approximately 1 nm; the thickness of the p-side second power supply layer **1502** is approximately 100 nm, and the thickness of the p-side third power supply layer **1503** is approximately 1000 nm.

Among these, the p-side first power supply layer **1501** has electronic conductivity and functions as an adhere layer which increases the adherence with the power supply insulating layer **170**. The p-side second power supply layer **1502** has electronic conductivity and functions as a diffusion prevention layer which prevents TaN constituting the p-side first power supply layer **1501** from diffusing toward the side of the p-side third power supply layer **1503**, and Au constituting the p-side third power supply layer **1503** from diffusing toward the side of the p-side first power supply layer **1501**. Moreover, the p-side third power supply layer **1503** has electronic conductivity and chemical stability, and functions as a surface layer used for the electronic connect to outside in the p-side power supply electrode **152**, for example.

In the present exemplary embodiment, the p-side connective electrode **154** is circular in shape in the view from top side (refer to FIG. **1**), and the diameter of the circle is approximately 10 μm and the circle has a tapered cross-sectional shape where the diameter gets smaller as the p-side transparent conductive layer **151** gets close. The inclination angle of the side wall in the p-side connective electrode **154** is approximately 80 degrees.

<N-Side Power Supply Portion **160**>

FIG. **6** is a diagram showing specific example of a configuration of the n-side power supply portion **160** according to the first exemplary embodiment. Here, FIG. **6** shows an enlarged cross-sectional view of a region VI shown in FIG. **3**, that is, an interface portion between the n-side power supply electrode **162** and the n-side connective electrode **164**. It should be noted that the n-side auxiliary electrode **163** which configures the n-side power supply portion **160** together with the n-side power supply electrode **162** and the n-side connective electrode **164**, and the n-side connective electrode **164** provided at the side of the n-side auxiliary electrode **163** (refer to FIG. **3**) have the configuration in common.

[N-Side Power Supply Electrode, n-Side Auxiliary Electrode and n-Side Connective Electrode]

The n-side power supply electrode **162**, the n-side auxiliary electrode **163**, and the n-side connective electrode **164** in the n-side power supply portion **160** are configured by laminating an n-side first power supply layer **1601**, an n-side second power supply layer **1602**, and an n-side third power supply layer **1603** in the order of being adjacent to the n-contact layer **121** in the n-type semiconductor layer **120** to be connected with. In present exemplary embodiment, the n-side first power supply layer **1601** is composed of TaN, the n-side second power supply layer **1602** is composed of Pt, and the n-side third power supply layer **1603** is composed of Au. The thickness of the n-side first power supply layer **1601** is approximately 1 nm; the thickness of the n-side second power supply layer **1602** is approximately 100 nm, and the thickness of the n-side third power supply layer **1603** is approximately 1000 nm.

Among these, the n-side first power supply layer **1601** has electronic conductivity and functions as an adhere layer which increases the adherence with the power supply insulating layer **170**. The n-side second power supply layer **1602** has electronic conductivity and functions as a diffusion prevention layer which prevents TaN constituting the n-side first power supply layer **1601** from diffusing toward the side of the n-side third power supply layer **1603**, and Au constituting the n-side third power supply layer **1603** from diffusing toward the side of the n-side first power supply layer **1601**. Moreover, the n-side third power supply layer **1603** has electronic conductivity and chemical stability, and functions as a surface layer used for the electronic connect to outside in the n-side power supply electrode **162**, for example.

As described above, in the present exemplary embodiment, the p-side power supply electrode **152**, the p-side auxiliary electrode **153** and the p-side connective electrode **154** in the p-side power supply portion **150**; and the n-side power supply electrode **162**, the n-side auxiliary electrode **163**, and the n-side connective electrode **164** in the n-side power supply portion **160** have the configuration in common.

In the present exemplary embodiment, the n-side connective electrode **164** is circular in shape in the view from top side (refer to FIG. **1**), and the diameter of the circle is approximately 10 μm and the circle has a tapered cross-sectional shape where the diameter gets smaller as the n-contact layer **121** gets close. The inclination angle of the side wall in the n-side connective electrode **164** is approximately 80 degrees.

<Power Supply Insulating Layer>

FIG. **7** is a diagram showing specific example of a configuration of the power supply insulating layer **170** shown in FIG. **1** to FIG. **4**. Here, FIG. **7** shows an enlarged cross-sectional view of a region VII shown in FIG. **2**. It should be noted that, in FIG. **7**, the p-side transparent conductive layer **151** provided at the lower side of the power supply insulating layer **170** is shown, on the other hand, each layer provided at the upper side of the power supply insulating layer **170** is omitted.

In the present exemplary embodiment, the power supply insulating layer **170** as an example of a transparent insulating layer has optical permeability to the light emitted from the light emitting layer **130** and insulating properties to electrically insulate the p-side power supply portion **150** and the n-side power supply portion **160**. As a material constituting the power supply insulating layer **170**, for example, $SiO_2$ (silicone dioxide), $MgF_2$ (magnesium fluoride), $CaF_2$ (calcium fluoride), $Si_3N_4$ (silicone nitride), $Al_2O_3$ (aluminum oxide) can be used. It should be noted that $SiO_2$ (silicone dioxide), which has high insulating properties and low refraction index (1.4 to 1.5) and is superior in terms of wet resistance, is used as the power supply insulating layer **170** in this specific example.

Moreover, the power supply insulating layer **170** of the present exemplary embodiment, as described-above, includes: the thin-film portion **171** as an example of a first transparent insulating portion; and the thick-film portion **172** as an example of a second transparent insulating portion. Here, when it is assumed that the thickness of the thin-film portion **171** is a first thickness t**1** and the thickness of the thick-film portion **172** is a second thickness t**2**, the first thickness t**1** and the second thickness t**2** have the relationship of t**1**<t**2**. In the power supply insulating layer **170**, the first thickness t**1** of the thin-film portion **171** is selected from values which are not likely to cause a total reflection in a wavelength of the light emitted from the light emitting layer **130**. On the other hand, the second thickness t**2** of the thick-film portion **172** is selected from values which are likely to cause a total reflection in a wavelength of the light emitted from the light emitting layer **130**. Therefore, the first thickness t**1** and the second thickness t**2** possibly have a relationship of t**1**>t**2**. It should be noted that in the present exemplary embodiment, the first thickness t**1** is set at 87 nm and the second thickness t**2** is set at 150 nm respectively by the wavelength of the light emitted from the light emitting layer **130** being 450 nm and the power supply insulating layer **170** having the above-described reflection rate.

Further, the power supply insulating layer **170** of the present exemplary embodiment does not only electrically insulate the p-side power supply portion **150** and n-side power supply portion **160** but also has a function of electrically insulating the n-side power supply portion **160** from the p-type semiconductor layer **140** and the light emitting layer **130**. The power supply insulating layer **170** has a function of diffusing positions of power supply from the p-side power supply portion **150** to the p-type semiconductor layer **140**.

<Protective Insulating Layer>

In the present exemplary embodiment, the protective insulating layer **180** has optical permeability to the light emitted from the light emitting layer **130** and insulating properties to electrically insulate the p-side power supply portion **150** and the n-side power supply portion **160**. As a material constituting the protective insulating layer **180**, for example, $SiO_2$ (silicone dioxide), $MgF_2$ (magnesium fluoride), $CaF_2$ (calcium fluoride), $Si_3N_4$ (silicone nitride), $Al_2O_3$ (aluminum oxide) can be used. It should be noted that $SiO_2$ (silicone dioxide) is used as the protective insulating layer **180** in this specific example, as well as the power supply insulating layer **170**. Here, the thickness of the protective insulating layer **180** is preferably approximately 90 nm.

(Light Emitting Device)

FIGS. **8**A and **8**B are diagrams showing specific examples of a configuration of a light emitting device **30** on which the semiconductor light emitting element **1** is mounted. Here, FIG. **8**A shows a top surface view of the light emitting device **30**, and FIG. **8**B is a VIIIB-VIIIB cross-sectional view in FIG. **8**A. It should be noted that the light emitting device **30** shown in FIGS. **8**A and **8**B is referred to as “light emitting chip”, or “lamp” in some cases.

The light emitting device **30** includes: a housing **31**, on one side of which a concave section **31***a* is formed; a p-lead section **32** and an n-lead section **33** composed of lead frames formed in the housing **31**; the semiconductor light emitting element **1** attached to a bottom surface of the concave section **31***a*; and a sealing section **34** provided to cover the concave section **31***a*. It should be noted that an illustration of the sealing section **34** is omitted in FIG. **8**A.

The housing **31** as a specific example of the base section is formed by injection molding of a white thermoplastic resin on a metal lead section including the p-lead section **32** as a specific example of a second wiring and the n-lead section **33** as a specific example of a first wiring.

The p-lead section **32** and the n-lead section **33** are metal plates having a thickness of the order of 0.1 mm to 0.5 mm, and configured by laminating several μm of nickel, titanium, gold or silver as a plating layer on an alloy of iron and copper, for example, which is a metal having excellent workability and thermal conductivity, as a base. Then, in the exemplary embodiment, part of each of the p-lead section **32** and the n-lead section **33** is exposed at the bottom surface of the concave section **31***a*. Further, one end portion of each of the p-lead section **32** and the n-lead section **33** is exposed to the outside of the housing **31** and is bent from an outer wall surface toward a back surface side of the housing **31**.

The semiconductor light emitting element **1** is attached by bonding or the like to the center portion of the bottom portion in the concave section **31***a* via the substrate **110** (refer to FIG. **2**). Further, the p-lead section **32** and the p-side power supply electrode **152** (refer to FIG. **1**) in the semiconductor light emitting element **1** are electrically connected by the not-shown bonding wire, and the n-lead section **33** and the n-side electrode **180** (refer to FIG. **1**) in the semiconductor light emitting element **1** are electrically connected by the not-shown bonding wire.

The sealing section **34** is configured with a transparent resin having high optical permeability in a visible region wavelength. As the resin constituting the sealing section **34**, which satisfies the properties of high heat resistance, high weather resistance and high mechanical strength, for example, an epoxy resin or a silicone resin can be used. In the present exemplary embodiment, a transparent plastic constituting the sealing section **34** contains a fluorescence body converts a part of the light emitted from the semiconductor light emitting element **1** into green light and red light. It should be noted that, in place of such the fluorescence body, the transparent plastic may contain a fluorescence body converts a part of blue light into yellow light or a fluorescence body converts a part of blue light into yellow light and red light. Also a transparent plastic containing no fluorescence body may be used as the sealing section **34**.

It should be noted that an electronic appliance, such as a backlight, a mobile cellular telephone, a display, various kinds of panels and the like, a computer, a game machine and illumination incorporating the light emitting device **30** according to the exemplary embodiment, and a mechanical device incorporating those electronic appliances, such as an automobile, is equipped with the semiconductor light emitting element **1** having excellent light emitting properties. Especially, in the electronic appliance, such as the backlight, the mobile cellular telephone, the display, the game machine and the illumination, which are battery-powered, an excellent product equipped with the semiconductor light emitting element **1** having excellent light emitting properties can be provided; and therefore, it is favorable. In addition, the configuration of the light emitting device **30** including the semiconductor light emitting element **1** is not limited to that shown in FIGS. **8**A and **8**B, and a package configuration called, for example, a shell type may be employed.

Then, description will be given of light emitting operation of the light emitting device **30** shown in FIGS. **8**A and **8**B and the semiconductor light emitting element **1** incorporated in the light emitting device **30**.

In the light emitting device **30**, when a current flows from the p-lead section **32** to the n-lead section **33** with respect to the semiconductor light emitting element **1**, in the semiconductor light emitting element **1**, a current from the p-side power supply portion **150** to the n-side power supply portion **160** is passed through the p-type semiconductor layer **140**, the light emitting layer **130** and the n-type semiconductor layer **120** (from the n-cladding layer **122** to the n-contact layer **121**). Then, in the p-side power supply portion **150**, current is supplied to the seven p-side connective electrodes **154** directly from the p-side power supply electrode **152** or through the p-side auxiliary electrode **153** (the p-side first auxiliary electrode **153***a* and the p-side second auxiliary electrode **153***b*), and current flows to the p-type semiconductor layer **140** from the respective p-side connective electrodes **154** through the p-side transparent conductive layer **151**. On the other hand, current is supplied to the three n-side connective electrodes **164** from n-contact layer **121** in the n-type semiconductor layer **120**, and current flows to the n-side power supply electrode **162** from two of these n-side connective electrodes **164** through the n-side auxiliary electrode **163** and directly from the rest of the one n-side connective electrode **164** in the n-side power supply portion **160**. With this current flow, the light emitting layer **130** emits light according to the configuration thereof (for example, blue light).

The light emitted from the light emitting layer **130** is further emitted to the outside of the semiconductor light emitting element **1**, and a part thereof is converted into the other color (red color and green color) by the fluorescence body contained in the sealing section **34**. Thereafter, the light containing blue light, green light and red light are emitted from a top surface of the sealing section **34** to the outside of the light emitting device **30** directly or after being reflected by an inner wall surface provided in the concave section **31***a* of the housing **31**.

Next, behavior of the light emitted from the light emitting layer **130** in the semiconductor light emitting element **1** shown in FIG. **1** and the like will be described.

In the semiconductor light emitting element **1**, light toward the side of the p-type semiconductor layer **140** and the light toward the side of the n-type semiconductor layer **120** are mainly emitted from the light emitting layer **130**.

Among these, the light toward the side of the n-type semiconductor layer **120** from the light emitting layer **130** is reflected at the interface portion, for example, between the n-contact layer **121** (actually the base layer) and the substrate **110** because of differences in reflection rate thereof. The light having approached into the inside of the substrate **110** is reflected at the interface portion between the substrate **110** and p-lead section **32** or n-lead section **33**. These reflected lights proceeds toward the side of the p-type semiconductor layer **140** through the light emitting layer **130**.

The light toward the side of the p-type semiconductor layer **140** from the light emitting layer **130** reaches the power supply insulating layer **170** through the p-type semiconductor layer **140** and the p-side transparent conductive layer **151**. Here, the light having reached the thin-film portion **171** among the power supply insulating layer **170** passes through the thin-film portion **171**, and is emitted outside through the protective insulating layer **180**. In contrast, the light having reached the thick-film portion **172** among the power supply insulating layer **170** is reflected at the thick-film portion **172**, and proceeds toward the side of the light emitting layer **130** through the p-side transparent conductive layer **151** and the p-type semiconductor layer **140**. The light having reached the light emitting layer **130** by being reflected at the thick-film portion **172** proceeds toward the side of the substrate **110** together with the light toward the n-type semiconductor layer **120** from the light emitting layer **130**, thereafter, is reflected in the above-described process, and proceeds toward the p-type semiconductor layer **140** again through the light emitting layer **130**, further, is emitted outside through the p-side transparent conductive layer **151**, the thin-film portion **171** of the power supply insulating layer **170**, and the protective insulating layer **180**.

In the present exemplary embodiment, since the n-side power supply electrode **162** and the n-side auxiliary electrode **163**, which electrically connect the plural n-side connective electrodes **164** in the n-side power supply portion **160**, are provided at the rear side of the p-type semiconductor layer **140** in the view from the light emitting layer **130**, it is not necessary to grind the light emitting layer **130** to connect the above electrodes. Therefore, it is possible to suppress decrease of the area of the light emitting layer **130** in the semiconductor light emitting element **1** having the same area as the light emitting layer **130**, as a result, it is possible to suppress decrease of the amount of the light emission.

Further, in the present exemplary embodiment, the light toward the respective above-described portions from the light emitting layer **130** is reflected at the thick-film portion **172** by providing the thick-film portion **172** in the power supply insulating layer **170** at the lower side of the p-side power supply electrode **152** and the p-side auxiliary electrode **153** (the p-side first auxiliary electrode **153***a* and the p-side second auxiliary electrode **153***b*) in the p-side power supply portion **150** (however, except for the forming portion of the p-side connective electrode **154**) and at the lower side of the n-side power supply electrode **162** and the n-side auxiliary electrode **163** in the n-side power supply portion **160** (however, except for the forming portion of the n-side connective electrode **164**), in the upper side of the p-type semiconductor layer **140**. Therefore, the light emitted from the light emitting layer **130** is not likely to be absorbed in the respective above-described portions, so it is possible to suppress decrease of the amount of the light emission still more. Especially, in the present exemplary embodiment, TaN colored ginger or black is used as the adhere layers (the p-side first power supply layer **1501** and the n-side first power supply layer **1601**) of the p-side power supply portion **150** and the n-side power supply portion **160**, thereby the light emitted from the light emitting layer **130** is easily absorbed. Therefore, applying such a configuration is effective.

In the present exemplary embodiment, in the upper side of the p-type semiconductor layer **140**, the light toward the portions which are not positioned lower side of the p-side power supply electrode **152**, the p-side auxiliary electrode **153**, the n-side power supply electrode **162** and the n-side auxiliary electrode **163** transmits at the thin-film portion **171** by providing the thin-film portion **171** in the power supply insulating layer **170**. Therefore, the light emitted from the light emitting layer **130** is easily emitted outside and it is possible to suppress decrease of the amount of the light emission still more.

Second Exemplary Embodiment

In the first exemplary embodiment, the n-side power supply electrode **162**, the n-side auxiliary electrode **163** and the n-side connective electrode **164** which configure the n-side power supply portion **160** are composed of metal materials. In contrast, in the present exemplary embodiment, among the n-side power supply portion **160**, the n-side power supply electrode **162** is composed of metal materials, on the other hand, the n-side auxiliary electrode **163** and the n-side connective electrode **164** are composed of transparent conductive materials. In the present exemplary embodiment, it should be noted that same symbols are assigned to configurations same as those in the first exemplary embodiment, and detailed description thereof will be omitted.

FIG. **9** is a diagram showing a specific example of an upper surface of a semiconductor light emitting element **1** according to the second exemplary embodiment. FIG. **10** is a X-X cross-sectional view in FIG. **9**. FIG. **11** is a XI-XI cross-sectional view in FIG. **9**. FIG. **12** is a XII-XII cross-sectional view in FIG. **9**.

The semiconductor light emitting element **1** of the present exemplary embodiment includes: a substrate **110**; an n-type semiconductor layer **120** (an n-contact layer **121** and an n-cladding layer **122**) laminated on the substrate **110**; a light emitting layer **130** laminated on the n-type semiconductor layer **120**; and a p-type semiconductor layer **140** laminated on the light emitting layer **130**. Moreover, the semiconductor light emitting element **1** includes; a p-side power supply portion **150** electrically connected to the p-type semiconductor layer **140**, and an n-side power supply portion **160** electrically connected to the n-type semiconductor layer **120**. Further, between the p-side power supply portion **150** and the n-side power supply portion **160**, the semiconductor light emitting element **1** includes; a power supply insulating layer **170** to electrically insulate the p-side power supply portion **150** and the n-side power supply portion **160** each other, and a protective insulating layer **180** that protects the light emitting layer **130** and the like from water which goes into inside of the semiconductor light emitting element **1** from outside and that electrically insulates the p-side power supply portion **150** and the n-side power supply portion **160** each other. It should be noted that, in FIG. **9**, the description of the protective insulating layer **180** is omitted, which is actually positioned at an uppermost layer (at the most front side)

Here, the p-side power supply portion **150** includes; a p-side transparent conductive layer **151** which is laminated on the p-type semiconductor layer **140** and on which the power supply insulating layer **170** is laminated; a p-side power supply electrode **152** and a p-side auxiliary electrode **153** which are laminated on the power supply insulating layer **170**; and plural p-side connective electrodes **154** (in this exemplary embodiment, three) that electrically connect the p-side transparent conductive layer **151** with any one of the p-side power supply electrode **152** and the p-side auxiliary electrode **153** via holes penetrating through the power supply insulating layer **170**.

In the p-side power supply portion **150** of the present exemplary embodiment, the p-side transparent conductive layer **151** is formed to cover the almost whole upper surface of the p-type semiconductor layer **140** except for peripheries thereof.

Moreover, in the p-side power supply portion **150** of the present exemplary embodiment, the p-side power supply electrode **152** is, on the top surface of the semiconductor light emitting element **1**, arranged at one edge side in the longitudinal direction (the right side in FIG. **9**) and at a center portion in the short direction, and has a circular shape in the view from top surface side. The protective insulating layer **180** is not laminated on the top surface of the p-side power supply electrode **152** (for example, refer to FIG. **11**), and the p-side power supply electrode **152** is exposed outside.

Furthermore, in the p-side power supply portion **150** of the present exemplary embodiment, one p-side auxiliary electrode **153** is integrated with the p-side power supply electrode **152** at the side of one edge and extends along the longitudinal direction of the semiconductor light emitting element **1** at the side of the other edge toward the p-side power supply electrode **162**. The protective insulating layer **180** is laminated on the top surface of the p-side auxiliary electrode **153** (for example, refer to FIG. **11**). Also in the present exemplary embodiment, one n-side connective electrodes **154** is provided at the lower side of the p-side auxiliary electrode **152**, and two p-side connective electrodes **154** are provided at the lower side of the p-side auxiliary electrode **153** respectively.

On the other hand, the n-side power supply portion **160** includes; an n-side transparent conductive layer **161** formed extending over the top of the power supply insulating layer **170** and the inside of plural holes (in this specific example, four holes) penetrating the power supply insulating layer **170**, the p-side transparent conductive layer **151** in the power supply portion **150**, the p-type semiconductor layer **140**, the light emitting layer **130**, and the n-clad layer **122** in the n-type semiconductor layer **120**; and the n-side power supply electrode **162** formed on the n-side transparent conductive layer **161** positioned on the power supply insulating layer **170**.

In the n-side power supply portion **160** of the present exemplary embodiment, the n-side transparent conductive layer **161** is formed covering almost the whole of the top surface of the power supply insulating layer **170** except for the p-side power supply electrode **152** and the p-side auxiliary electrode **153** in the p-side power supply portion **150** (specifically the forming portion of the thick-film portion **172** provided to correspond to the p-side power supply electrode **152** and the p-side auxiliary electrode **153** among the thick-film portion **170**).

Further, in the n-side power supply portion **160** of the present exemplary embodiment, the n-side power supply electrode **162** is, on the top surface of the semiconductor light emitting element **1**, arranged at the other edge side in the longitudinal direction (the left side in FIG. **9**) and at a center portion in the short direction, and has a circular shape in the view from top surface side. The protective insulating layer **180** is not laminated on the top surface of the n-side power supply electrode **162** (for example, refer to FIG. **11**), and the n-side power supply electrode **162** is exposed outside.

Here, in the present exemplary embodiment, the portion formed on the power supply insulating layer **170** functions as the n-side auxiliary electrode **163**, and the portions formed inside of the holes provided at the four places (in this specific example, four holes) respectively function as the n-side connective electrode **164** among the n-side transparent conductive layer **161**. Thus the above-described n-side power supply electrode **162** is provided on the n-side transparent connective layer **161** functions as the n-side auxiliary electrode **163** in the state of being electrically connected to the n-side transparent conductive layer **161**.

Moreover, the above-described power supply insulating layer **170** is provided on the respective side walls of the plural holes provided to correspond to the n-side transparent conductive layer **161** configuring the respective n-side connective electrodes **164**. Therefore, the respective n-side connective electrodes **164** are not directly contact with at least the p-side transparent conductive layer **151**, the p-type semiconductor layer **140**, and the light emitting layer **130**. On the other hand, the power supply insulating layer **170** is not provided on the lower side portion of the plural holes, and the respective n-side connective electrodes **164** and the n-side contact layer **121** are directly contacted.

In this specific example, It should be noted that the n-side connective electrode **164** is not provided at the lower side of the n-side power supply electrode **162**, but the n-side connective electrode **164** may be provided at the lower side of the n-side power supply electrode **162** as well as the first exemplary embodiment.

Further, in the n-side power supply portion **160** of the present exemplary embodiment, the thick-film portion **172** in the power supply insulating layer **170** is provided on the portions at lower side of the p-side power supply electrode **152** and the p-side auxiliary electrode **153** which configure the p-side power supply portion **150**, and provided on the portions at the lower side of the n-side power supply electrode **162** which configures the n-side power supply portion **160**, and the thin-film portion **171** is provided on the portions except for the thick-film portion **172**. Therefore in the present exemplary embodiment, the configuration in which the thin-film portion **171** in the power supply insulating layer **170** is provided at the lower side of the **163** configuring the n-side power supply portion **160** (except for lower side of portions where the n-side power supply electrode **162** is formed) is different from that of the first exemplary embodiment.

Moreover, the protective insulating layer **180** covers the top surfaces of the semiconductor light emitting element **1** except for the p-side power supply electrode **152** in the p-side power supply portion **150** and except for the n-side power supply electrode **162** in the n-side power supply portion **160**. In this specific example, the protective insulating layer **180** is laminated inside of the four holes provided to correspond to the n-side connective electrode **164**.

In the semiconductor light emitting element **1** of the present exemplary embodiment, for example like shown in FIG. **10** to FIG. **12**, the power supply insulating layer **170**, the n-side transparent conductive layer **161**, and the protective insulating layer **180** cover the side surfaces of the light emitting layer **130** and the p-type semiconductor layer **140**. However, since the power supply insulating layer **170** is provided, the n-side transparent conductive layer **161** is not directly contact with the side surface of the n-type semiconductor layer **120**, the light emitting layer **130** and the p-type semiconductor layer **140**.

The details of the n-side transparent conductive layer **161** which is a characteristic configuration element in the present exemplary embodiment will be explained below.

[N-Side Transparent Conductive Layer]

As the n-side transparent conductive layer **161**, it is preferable to employ those that can make an ohmic contact with the n-contact layer **121** in the n-type semiconductor layer **120** and has small contact resistance with the n-contact layer **121**. Further, in the semiconductor light emitting element **1**, since the light from the light emitting layer **130** is emitted to the protective insulating layer **180** side via the n-side transparent conductive layer **161**, it is preferable to employ those having excellent optical permeability as the n-side transparent conductive layer **161**. Still further, for uniformly passing a current over the entire surface of the n-type semiconductor layer **120**, it is preferable to use the n-side transparent conductive layer **161** having excellent conductivity and narrow resistance distribution.

It should be noted that the thickness of the n-side transparent conductive layer **161** can be selected from the range of 2 nm to 500 nm. Here, if the thickness of the n-side transparent conductive layer **161** is less than 2 nm, there are some cases where an ohmic contact with the n-contact layer **121** is hardly available, and if the thickness of the n-side transparent conductive layer **161** is more than 500 nm, there are some cases that are not preferable in terms of optical permeability to the light emitted from the light emitting layer **130**.

The material explained in the terms of the p-side transparent conductive layer **151** in the first exemplary embodiment can be used as a material constituting the n-side transparent conductive layer **161**. In the present exemplary embodiment, it should be noted that the n-side transparent conductive layer **161** is composed of the same material as the p-side transparent conductive layer **151**.

The n-side power supply electrode **162** in the present exemplary embodiment is configured with the n-side first power supply layer **1601** composed of TaN, the n-side second power supply layer **1602** composed of Pt, and the n-side third power supply layer **1603** composed of Au laminated as well as the first exemplary embodiment. Therefore in the present exemplary embodiment, the p-side power supply electrode **152**, the p-side auxiliary electrode **153** and the p-side connective electrode **154** in the p-side power supply portion **150**, and the n-side power supply electrode **162** in the n-side power supply portion **160** have the configuration in common.

The semiconductor light emitting element **1** of the present exemplary embodiment can be used by being incorporated into the light emitting device **30** shown in FIGS. **8**A and **8**B, similarly to the semiconductor light emitting element **1** explained in the first exemplary embodiment. Hereinafter, description will be given of light emitting operation of the light emitting device **30** shown in FIGS. **8**A and **8**B and the semiconductor light emitting element **1** incorporated in the light emitting device **30**.

In the light emitting device **30**, when a current flows from the p-lead section **32** to the n-lead section **33** with respect to the semiconductor light emitting element **1**, in the semiconductor light emitting element **1**, a current from the p-side power supply portion **150** to the n-side power supply portion **160** is passed through the p-type semiconductor layer **140**, the light emitting layer **130** and the n-type semiconductor layer **120** (from the n-cladding layer **122** to the n-contact layer **121**). Then, in the p-side power supply portion **150**, current is supplied to the three p-side connective electrodes **154** directly from the p-side power supply electrode **152** or through the p-side auxiliary electrode **153**, and current flows to the p-type semiconductor layer **140** through the p-side transparent conductive layer **151** from the respective p-side connective electrodes **154**. On the other hand, current is supplied to the four n-side connective electrode **164** from the n-contact layer **121** in the n-type semiconductor layer **120**, and current flows to the n-side power supply electrode **162** through the n-side auxiliary electrode **163** from the four n-side connective electrodes **164** in the n-side power supply portion **160**. In another point of view, the n-side power supply electrode **162** is supplied a current through the n-side transparent conductive **161** from the four portions in the n-contact layer **121** (the forming places of the respective holes) in the n-side power supply portion **160**. Accordingly, light emitting layer **130** outputs light (for example, blue light) corresponding to the composition thereof.

The light emitted from the light emitting layer **130** is further emitted to the outside of the semiconductor light emitting element **1**, and a part of that is converted into the other colors (red color and green color) by the fluorescence body contained in the sealing section **34**. Thereafter, the light containing green light and red light is emitted from a top surface of the sealing section **34** to the outside of the light emitting device **30** directly or after being reflected by an inner wall surface provided in the concave section **31***a* of the housing **31**.

Next, behavior of the light emitted from the light emitting layer **130** in the semiconductor light emitting element **1** shown in FIG. **9** and the like will be described.

In the semiconductor light emitting element **1**, the light toward the side of the p-type semiconductor layer **140** and the light toward the side of the n-type semiconductor layer **120** are mainly emitted from the light emitting layer **130**.

Among these, the light toward the side of the n-type semiconductor layer **120** from the light emitting layer **130** is reflected, for example, at the interface portion between the n-contact layer **121** (actually the base layer) and the substrate **110** by differences in reflection rate thereof. The light having approached into the inside the substrate **110** is reflected at the interface portion between the substrate **110** and the p-lead portion **32** or the n-lead portion **33**. These reflected light proceeds toward the side of the p-type semiconductor layer **140** through the light emitting layer **130**.

The light toward the side of the p-type semiconductor layer **140** from the light emitting layer **130** reaches the power supply insulating layer **170** through the p-type semiconductor layer **140** and the p-side transparent conductive layer **151**. Here, the light having reached the thin-film portion **171** among the power supply insulating layer **170** passes through the thin-film portion **171** and is emitted outside by passing through the n-side transparent conductive layer **161** (the n-side auxiliary electrode **163**) and the protective insulating layer **180**. In contrast, the light having reached the thick-film portion **172** among the power supply insulating layer **170** is reflected at the thick-film portion **172** and proceeds toward the side of the light emitting layer **130** through the p-side transparent conductive layer **151** and the p-type semiconductor layer **140**. The light having reached the light emitting layer **130** by being reflected at the thick-film portion **172** proceeds toward the side of the substrate **110** together with the light toward the n-type semiconductor layer **120** from the light emitting layer **130**, thereafter, proceeds toward the side of the p-type semiconductor layer **140** through the light emitting layer **130** again by being reflected in the above-described process, and is emitted outside through the p-side transparent conductive layer **151**, the thin-film portion **171** of the power supply insulating layer **170**, the n-side transparent conductive layer **161**, and the protective insulating layer **180**.

In the present exemplary embodiment, because the n-side power supply electrode **162** and the n-side auxiliary electrode **163**, which electrically connect the plural n-side connective electrodes **164** in the n-side power supply portion **160**, are provided at the rear side of the p-type semiconductor layer **140** in the view from the light emitting layer **130**, it is not necessary to grind the light emitting layer **130** to connect the above electrodes. Therefore, it is possible to suppress decrease of the area of the light emitting layer **130** in the semiconductor light emitting element **1** having the same area as the light emitting layer **130**, as a result, it is possible to suppress decrease of the amount of the light emission.

Further, in the present exemplary embodiment, it is possible to make the light toward the n-side auxiliary electrode **163** from the light emitting layer **130** be transmitted directly, compared with the first exemplary embodiment, by configuring the n-side auxiliary electrode **163** and the plural n-side connective electrodes **164** in the n-side power supply portion **160** with a transparent conductive material and providing the thin-film portion **171** in the power supply insulating layer **170** at the rear side of the n-side auxiliary electrode **163**. Therefore, it is possible to suppress decrease of the amount of the light repeatedly reflected inside the semiconductor layer **1** so that, it is possible to improve the light emission.

In the present exemplary embodiment, the thick-film portion **172** in the power supply insulating layer **170** is provided at the rear side of the n-side power supply electrode **162** composed of a metal material among the n-side power supply portion **160** as well as the first exemplary embodiment, thereby the light toward the n-side power supply electrode **162** from the light emitting layer **130** is reflected at the thick-film portion **172** and is not easily absorbed by the n-side power supply electrode **162**, which results in that it is possible to suppress decrease of the amount of the light emission.

Third Exemplary Embodiment

In the third exemplary embodiment, the configuration is almost the same as the second exemplary embodiment, but the position and the configuration of the p-side power supply portion **150** and the n-side power supply portion **160** in the semiconductor layer **1** is different from that of second exemplary embodiment. In the present exemplary embodiment, it should be noted that same symbols are assigned to configurations same as those in the exemplary embodiment 2, and detailed description thereof will be omitted.

FIG. **13** is a specific example of an upper surface of a semiconductor light emitting element **1** according to the third exemplary embodiment. FIG. **14** is a XIV-XIV cross-sectional view in FIG. **13**. FIG. **15** is a XV-XV cross-sectional view in FIG. **13**. FIG. **16** is a XVI-XVI cross-sectional view in FIG. **13**.

The semiconductor light emitting element **1** of the present exemplary embodiment includes: a substrate **110**; an n-type semiconductor layer **120** (an n-contact layer **121** and an n-cladding layer **122**) laminated on the substrate **110**; a light emitting layer **130** laminated on the n-type semiconductor layer **120**; and a p-type semiconductor layer **140** laminated on the light emitting layer **130**. Moreover, the semiconductor light emitting element **1** includes; a p-side power supply portion **150** electrically connected to the p-type semiconductor layer **140**, and an n-side power supply portion **160** electrically connected to the n-type semiconductor layer **120**. Further, between the p-side power supply portion **150** and the n-side power supply portion **160**, the semiconductor light emitting element **1** includes; a power supply insulating layer **170** to electrically insulate the p-side power supply portion **150** and the n-side power supply portion **160** each other, and a protective insulating layer **180** that protects the light emitting layer **130** and the like from water which goes into inside of the semiconductor light emitting element **1** from outside and that electrically insulates the p-side power supply portion **150** and the n-side power supply portion **160** each other. It should be noted that, in FIG. **9**, the description of the protective insulating layer **180** is omitted, which is actually positioned at an uppermost layer (at the most front side)

Here, the p-side power supply portion **150** includes; a p-side transparent conductive layer **151** which is laminated on the p-type semiconductor layer **140** and on which the power supply insulating layer **170** is laminated; a p-side power supply electrode **152** and a p-side auxiliary electrode **153** which are laminated on the power supply insulating layer **170**; and plural p-side connective electrodes **154** (in this exemplary embodiment, seven) that electrically connect the p-side transparent conductive layer **151** with any one of the p-side power supply electrode **152** and the p-side auxiliary electrode **153** via holes penetrating through the power supply insulating layer **170**.

In the p-side power supply portion **150** of the present exemplary embodiment, the p-side transparent conductive layer **151** is formed to cover the almost whole upper surface of the p-type semiconductor layer **140** except for peripheries thereof.

Moreover, in the p-side power supply portion **150** of the present exemplary embodiment, the p-side power supply electrode **152** is, on the top surface of the semiconductor light emitting element **1**, arranged at one edge side in the longitudinal direction (the right side in FIG. **13**) and at a center portion in the short direction, and has a circular shape in the view from top surface side. The protective insulating layer **180** is not laminated on the top surface of the p-side power supply electrode **152** (for example, refer to FIG. **15**), and the p-side power supply electrode **152** is exposed outside.

Furthermore, in the p-side power supply portion **150** of the present exemplary embodiment, the p-side auxiliary electrode **153** includes: an L-shaped p-side first auxiliary electrode **153***a* which is integrated with the p-side power supply electrode **152** at the side of one edge and extends along the semiconductor light emitting element **1** at the side of the other edge in the longitudinal direction; and an L-shaped p-side second auxiliary electrode **153***b* which is integrated with the p-side power supply electrode **152** at the side of one edge and extends along the longitudinal direction of the semiconductor light emitting element **1** at the side of the other edge. Here, in the present exemplary embodiment, the p-side first auxiliary electrode **153***a* and the p-side second auxiliary electrode **153***b* do not come into directly contact with each other by providing the p-side first auxiliary electrode **153***a* at the side of one edge in the short direction of the semiconductor light emitting element **1** (at the side of the upper part in FIG. **13**) and the p-side second auxiliary electrode **153***b* at the side of the other edge in the short direction of the semiconductor light emitting element **1** (at the side of the lower part FIG. **13**). The protective insulating layer **180** is laminated on the top surfaces of these the p-side first auxiliary electrode **153***a* and the p-side second auxiliary electrodes **153***b* (for example, refer to FIG. **14** and FIG. **16**). Also, in the present exemplary embodiment, the p-side connective electrode **154** is provided at the lower side of the p-side power supply electrode **152**, the three p-side connective electrodes **154** are provided at the lower side of the p-side first auxiliary electrode **153***a*, and the three p-side connective electrodes **154** are provided at the lower side of the p-side second auxiliary electrode **153***b* respectively.

On the other hand, the n-side power supply portion **160** includes: an n-side transparent conductive layer **161** formed extending over the top of the power supply insulating layer **170** and the inside of plural holes (in this specific example, two holes) penetrating the power supply insulating layer **170**, the p-side transparent conductive layer **151** in the power supply portion **150**, the p-type semiconductor layer **140**, the light emitting layer **130**, and the n-clad layer **122** in the n-type semiconductor layer **120**; and the n-side power supply electrode **162** formed on the n-side transparent conductive layer **161** positioned on the power supply insulating layer **170**.

In the n-side power supply portion **160** of the present exemplary embodiment, the n-side transparent conductive layer **161** is formed to cover almost the whole of the top surfaces of the power supply insulating layer **170** except for the forming portions of the p-side power supply portion **150** (specifically the forming portions of the thick-film portion **172** provided to correspond to the p-side power supply electrode **152** and the p-side auxiliary electrode **153** among the power supply insulating layer **170**).

Further, in the n-side power supply portion **160** of the present exemplary embodiment, the n-side power supply electrode **162**, on the top surface of the semiconductor light emitting element **1**, arranged at the other edge side in the longitudinal direction (the left side in FIG. **13**) and at a center portion in the short direction (an area interposed between the p-side first auxiliary electrode **153***a* and p-side second auxiliary electrode **153***b* which configure the p-side power supply portion **150**), and has a circular shape in the view from top surface side. The protective insulating layer **180** is not laminated on the top surface of the n-side power supply electrode **162** (for example, refer to FIG. **15**), and the n-side power supply electrode **162** is exposed outside.

Here, in the present exemplary embodiment, the portion formed on the power supply insulating layer **170** functions as the n-side auxiliary electrode **163**, and the portions formed inside of the holes provided at the two places (in this specific example, two holes) respectively function as the n-side connective electrode **164** among the n-side transparent conductive layer **161**. Thus the above-described n-side power supply electrode **162** is provided on the n-side transparent connective layer **161** functions as the n-side auxiliary electrode **163** in the state of being electrically connected to the n-side transparent conductive layer **161**.

Moreover, the above-described power supply insulating layer **170** is provided on the respective side walls of the plural holes provided to correspond to the n-side transparent conductive layer **161** configuring the respective n-side connective electrodes **164**. Therefore, the respective n-side connective electrodes **164** are not directly contact with at least the p-side transparent conductive layer **151**, the p-type semiconductor layer **140**, and the light emitting layer **130**. On the other hand, the power supply insulating layer **170** is not provided on the lower side portion of the plural holes, and the respective n-side connective electrodes **164** and the n-side contact layer **121** are directly contacted.

In this specific example, it should be noted that the n-side connective electrode **164** is not provided at the lower side of the n-side power supply electrode **162**, but the n-side connective electrode **164** may be provided at the lower side of the n-side power supply electrode **162** as well as the first exemplary embodiment.

Further, in the present exemplary embodiment, the thick-film portion **172** in the power supply insulating layer **170** is provided on the portions at lower side of the p-side power supply electrode **152** and the p-side auxiliary electrode **153** which configure the p-side power supply portion **150** and on the portions at the lower side of the n-side power supply electrode **162** configures the n-side power supply portion **160**, and the thin-film portion **171** is provided on the portions except for the thick-film portion **172**.

Moreover, the protective insulating layer **180** covers the top surfaces of the semiconductor light emitting element **1** except for the p-side power supply electrode **152** in the p-side power supply portion **150** and the n-side power supply electrode **162** in the n-side power supply portion **160**. In this specific example, the protective insulating layer **180** is laminated inside of the two holes provided to correspond to the n-side connective electrode **164** as well.

In the semiconductor light emitting element **1** of the present exemplary embodiment, for example like shown in FIG. **14** to FIG. **16**, the power supply insulating layer **170**, the n-side transparent conductive layer **161** and the protective insulating layer **180** cover the side surfaces of the light emitting layer **130** and the p-type semiconductor layer **140**. However, since the power supply insulating layer **170** is provided, the n-side transparent conductive layer **161** is not directly contact with the side surface of the n-type semiconductor layer **120**, the light emitting layer **130** and the p-type semiconductor layer **140**.

The semiconductor light emitting element **1** in the present exemplary embodiment can be used by installing in the light emitting device **30** shown in FIG. **8** as well as in the first exemplary embodiment. However, explanation of the detail of the light emitting working in the case of installing the semiconductor light emitting element **1** in the present exemplary embodiment in the light emitting device **30** shown in FIG. **8** is omitted here because the detail is basically the same as in the second exemplary embodiment.

In the first to the third exemplary embodiment, an example of the semiconductor light emitting element **1** composed of the a group III nitride semiconductor as a compound semiconductor is explained, but the semiconductor light emitting element **1** may be composed of a group III-V semiconductor and a group II-VI semiconductor.

The foregoing description of the exemplary embodiment of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in the art. The exemplary embodiment was chosen and described in order to best explain the principles of the invention and its practical applications, thereby enabling others skilled in the art to understand the invention for various embodiments and with the various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalents.

What is claimed is:

**1**. A semiconductor light emitting element comprising:

a first semiconductor layer that is composed of a compound semiconductor with a first conductive type;

a light emitting layer that is provided on the first semiconductor layer to be in contact with the first semiconductor layer, is composed of a compound semiconductor, and emits light with current flow;

a second semiconductor layer that is provided on the light emitting layer to be in contact with the light emitting layer and composed of a compound semiconductor with a second conductive type different from the first conductive type;

a first power supply electrode that is provided at a rear side of the second semiconductor layer in the view from the light emitting layer, is composed of metal, and electrically connected to the first semiconductor layer;

a second power supply electrode that is provided at the rear side of the second semiconductor layer in the view from the light emitting layer, is composed of metal, and electrically connected to the second semiconductor layer; and

a transparent insulating layer that is provided at the rear side of the second semiconductor layer in the view from the light emitting layer, is composed of materials having permeability to the light of a wavelength emitted from the light emitting layer, and electrically insulates the first power supply electrode and the second power supply electrode; wherein,

the transparent insulating layer comprises;

a first transparent insulating portion that is set to have a first thickness with which the light emitted from the light emitting layer is transmitted, and is provided on portions provided at the rear side of the second semiconductor layer in the view from the light emitting layer and provided not to correspond to the first power supply electrode and the second power supply electrode; and

a second transparent insulating portion that is set to have a second thickness with which the light emitted from the light emitting layer is reflected, and is provided on portions between the second semiconductor layer and the first power supply electrode and on portions between the second semiconductor layer and the second power supply electrode.

**2**. The semiconductor light emitting element according to claim **1**, further comprising a first connective electrode that is electrically connected to the first semiconductor layer through a hole penetrating the transparent insulating layer, the second semiconductor layer and the light emitting layer; and a first auxiliary electrode that is provided at the rear side of the second semiconductor layer in the view from the light emitting layer and electrically connects the first connective electrode and the first power supply electrode.

**3**. The semiconductor light emitting element according to claim **2**, wherein, the first auxiliary electrode is composed of metal, and the second transparent insulating portion is provided between the second semiconductor layer and the first auxiliary electrode.

**4**. The semiconductor light emitting element according to claim **2**, wherein,

the first connective electrode and the first auxiliary electrode are composed of transparent conductive materials having electronic conductivity and permeability to the light emitted from the light emitting layer.

**5**. The semiconductor light emitting element according to claim **1**, wherein,

the compound semiconductor is composed of a group III nitride semiconductor, and

the first semiconductor layer is laminated on a substrate directly or through another layer.

**6**. The semiconductor light emitting element according to claim **2**, wherein,

the compound semiconductor is composed of a group III nitride semiconductor, and

the first semiconductor layer is laminated on a substrate directly or through another layer.

**7**. The semiconductor light emitting element according to claim **3**, wherein,

the compound semiconductor is composed of a group III nitride semiconductor, and

the first semiconductor layer is laminated on a substrate directly or through another layer.

**8**. The semiconductor light emitting element according to claim **4**, wherein,

the compound semiconductor is composed of a group III nitride semiconductor, and

the first semiconductor layer is laminated on a substrate directly or through another layer.

**9**. A light emitting device comprising:

a base portion in which a first wiring and a second wiring are formed; and

a semiconductor light emitting element that is connected to the base portion by face up mounting, wherein

the semiconductor light emitting element comprises:

a first semiconductor layer that is composed of a compound semiconductor with a first conductive type;

a light emitting layer that is provided on the first semiconductor layer to be in contact with the first semiconductor layer, is composed of a compound semiconductor, and emits light with current flow;

a second semiconductor layer that is provided on the light emitting layer to be in contact with the light emitting layer and composed of a compound semiconductor with a second conductive type different from the first conductive type;

a first power supply electrode that is provided at a rear side of the second semiconductor layer in the view from the light emitting layer, is composed of metal, electrically connected to the first semiconductor layer, and electrically connected to the first wiring provided on the base portion;

a second power supply electrode that is provided at the rear side of the second semiconductor layer in the view from the light emitting layer, is composed of metal, electrically connected to the second semiconductor layer, and electrically connected to the second wiring provided on the base portion; and

a transparent insulating layer that is provided at the rear side of the second semiconductor layer in the view from the light emitting layer, is composed of materials having permeability to the light of a wavelength emitted from the light emitting layer, and electrically insulates the first power supply electrode and the second power supply electrode; wherein,

the transparent insulating layer comprises:

a first transparent insulating portion that is set to have a first thickness with which the light emitted from the light emitting layer is transmitted, and is provided on portions provided at the rear side of the second semiconductor layer in the view from the light emitting layer and provided not to correspond to the first power supply electrode and the second power supply electrode; and

a second transparent insulating portion that is set to have a second thickness with which the light emitted from the light emitting layer is reflected, and is provided on portions between the second semiconductor layer and the first power supply electrode and on portions between the second semiconductor layer and the second power supply electrode.

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